5-4930-227-14

TM 5-4930-227-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT AND
GENERAL SUPPORT MAINTENANCE MANUAL

TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

This copy is a reprint which includes current pages from Changes 2 through 10.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1969

D 101.11:

READEX FICHE best copy available

SAFETY PRECAUTIONS

BEFORE OPERATION

When hose reel is turned to remove the hose, the recoil spring tension is increased. Before performing maintenance on the hose reel, carefully rewind reel to release spring tension.

Do not operate the pumping assembly in an inclosed area, unless the exhaust gases are piped to the outside. Continued breathing of exhaust fumes is dangerous and may be fatal.

Do not smoke or use an open flame within 50 feet of the tank and pump unit.

When filling the fuel tank, always provide a metal-to-metal contact between the container and the fuel tank. This will prevent a spark from being generated as fuel flows over the metallic surfaces.

Do not operate the tank and pump unit until it has been properly grounded.

DURING OPERATION

Do not fill the fuel tank while the engine is in operation. Gasoline spilled on a hot engine may explode and cause severe injury to personnel. Stop engine and allow to cool before refueling.

Do not operate the engine in an inclosed area, unless the exhaust gases are piped to the outside. Continued breathing of exhaust fumes is dangerous and may be fatal.

Do not smoke or use an open flame around the tank and pump unit.

When dispensing fuel attend the nozzles constantly; do not wedge open or block the control lever.

AFTER OPERATION

Do not smoke or use an open flame around the tank and pump unit.

When filling the fuel tank, always provide a metal-to-metal contact between the container and fuel tank.

Clean tanks **before repair, shipping or storage.**

Refer to TB 1047, February 1963, and paragraph 6–9 of this manual before attempting any weld repairs on fuel tanks.

Extreme caution must be observed in transporting filled tanks by truck. Refer to maximum load limits.

Do not drain flammable liquid into body of transporting vehicle.

Changes in force: C2, C3, C4, C5, C6, C7, C8, C9 and C10

TM 5-4930-227-14
C-10

CHANGE
No. 10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 31 May 1988

Operator, Organizational, Direct and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) NSN 4930-00-877-8678

TM 5-4930-227-14, June 1969 is changed as follows:

Inside front cover is superseded as follows:

WARNING

When hose reel is turned to remove hose, the recoil spring tension is increased.

Before performing maintenance on the hose reel, carefully unwind reel to release sprint tension.

Do not disassemble spring housing assembly.

The spring is under tension and can cause serious injury or death if disassembled improperly. Repair of spring housing assembly is by replacement only.

WARNING

FLAMMABLE FUEL

DEATH or serious injury may result if personnel fail to observe safety precautions.

Do not smoke or use open flame within 50 feet (15.24 meters) of the tank and pump unit.

Be sure proper grounding procedures have been followed prior to operating the equipment.

Do not refuel the GED pump assembly fuel can while the engine is operating; stop engine and allow to cool before refueling.

If fuel is spilled, wash the area of spillage thoroughly with water.

After refueling operation is completed, replace the filler cap securely before removing the nozzle bonding wire.

WARNING

Operation of this equipment presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits for unprotected personnel. Wear ear muffs or earplugs which were fitted by a trained professional.

WARNING

All aircraft fuel must be dispensed through a filter/separator unit. It is mandatory that the performance of filter/separators on all aircraft refueling equipment be checked every 30 days through submission of samples taken from the effluent stream of the filter/separator.

WARNING

DEATH or SERIOUS INJURY may result if personnel fail to heed Safety Precautions for welding. Prior to welding, read welding instructions contained in Chapter 6, on repair of the Tank Assembly.

If conditions require fuel tank repairs by welding or other methods involving heat or flame, be sure that all fumes are purged from the tank or fill tank with water before commencing the repair. If possible, tank should be filled with water prior to welding after being thoroughly purged of fumes. Applying heat or flame to a fuel tank containing residue may result in a violent explosion, causing injury or death to personnel.

Personnel engaged in purging operations will not wear wool, nylon, silk, rayon, or other similar static

electricity generating clothing. Clean cotton clothing with no metal buttons or fittings will be worn. All contents will be removed from pockets.

The tank being purged must have a static ground during all operations. Precautions should be taken with all tools and metal objects around the tank to ensure no spark will be made. Conduct a combustible vapor test reading prior to purging the tank using an acceptable explosive meter.

Only competent personnel thoroughly instructed in the proper handling and reading of the explosive meter will conduct vapor tests. Conduct a combustible vapor test reading immediately after purging. Under no circumstances will repair of the tank begin until declared safe by safety personnel. Discontinue all operations if an electrical storm is threatening or in progress. Eliminate conditions that could cause explosions.

WARNING

Operate GED engine in a well ventilated location. Carbon monoxide is a deadly gas that is given off by a gasoline engine. It is odorless and tasteless. The first evidence of its presence is that the operator of the equipment will have a headache or suffer from a feeling of dizziness.

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 degrees F to 138 degrees F (38 degrees C to 59 degrees C).

WARNING

Do not touch metal parts with bare skin during cold weather. The skin may stick to the metal.

WARNING

For the electric motor driven pumping assembly, disconnect power cable from vehicle slave receptacle before replacing or repairing motor or electrical components. When connecting power cable be sure Remote ON-OFF Switch is in "OFF" position. Low voltage can cause Severe Shock or Death.

WARNING

Equipment must not be used for other than the intended purpose. Failure to heed this warning can cause damage to equipment and/or injury or death to personnel.

WARNING

Transportation or storage of liquid, other than petroleum products, is hazardous to personnel and can damage the equipment.

Page 1-1, paragraph 1-4a. Delete the caution.

Page 1-1, paragraph 1-4a is superseded as follows:

a. General

The tank and pump unit (figure 1-1) consists of a 50 gpm (189 liters per minute) pumping assembly, two 600-gallon (2271-liter) tanks and related items. It is designed for use with 5-ton Cargo Truck such as M-54, M-55, M813A1, M814, M923, M924, M925 and M926. When installed in a cargo truck, the tank and pump unit is used in the field as a bulk carrier and dispenser. It carries 1200 gallons (4542 liters). The purpose of the tank and pump unit is to convert a general purpose military cargo vehicle into the bulk refueler. The maintenance paragraphs contain detailed descriptions of its components. (NOTE: Electric Motor Driven Pump requires Slave Receptacle mounted at right rear side of cab).

Page 1-1, paragraph 1-4b. In the paragraph heading and the first sentence, "Pumping Assembly" is changed to "Pump Unit".

Page 1-1, paragraph 1-4c.1. The first sentence is changed to read "Electric Motor Driven Pump. The electric motor driven pump (Figure 1-4.1) is a self-priming unit, with the impeller mounted on the extended shaft of the electric motor."

Page 1-1, paragraph 1-4d.1, change "1.33 hp" to "1.5 hp." Add the following sentence to paragraph 1-4d.1. "The electric motor driven pump assembly requires two cables (Figure 1-4.1)."

Page 1-1, immediately after paragraph 1-4d.1, add the following note:

NOTE

Electric Motor Driven Pump requires slave receptacle mounted at right rear side of cab.

Page 1-6, paragraph 1-5a (2.1) is superseded as follows: 1-5a (2.1) Electric Motor Pump Assembly. Located on the pump end of the skid (See Fig. 1-4.1).

Page 1-5, after figure 1-4, add figure 1-4.1.

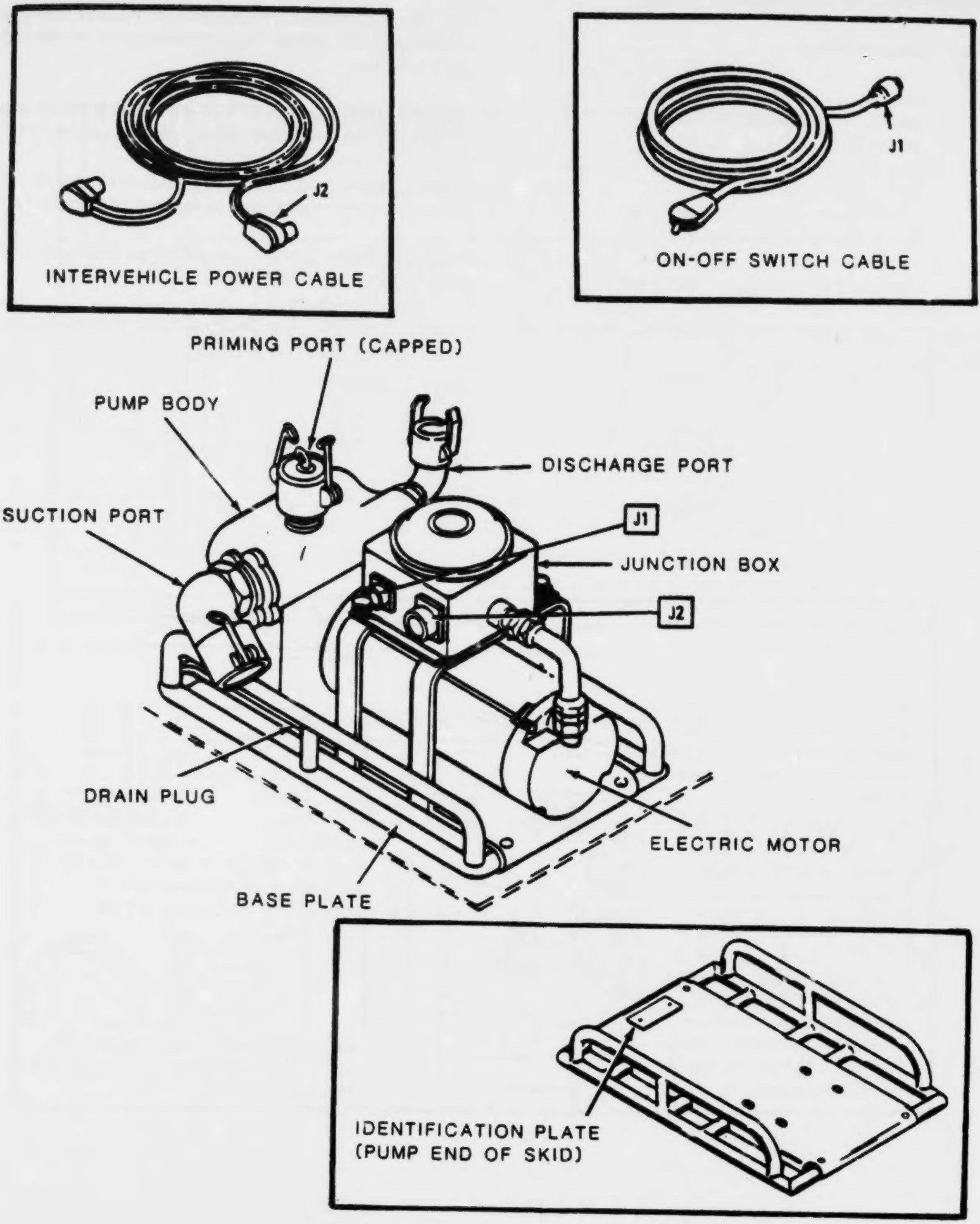

J2
INTERVEHICLE POWER CABLE
J1
ON-OFF SWITCH CABLE
PRIMING PORT (CAPPED)
PUMP BODY
DISCHARGE PORT
SUCTION PORT
J1
JUNCTION BOX
J2
DRAIN PLUG
ELECTRIC MOTOR
BASE PLATE
IDENTIFICATION PLATE
(PUMP END OF SKID)

Figure 1-4.1 Pump Assembly (EMD).

Page 1-6, paragraph 1-5b (1.1), Tabulated Data for the Electric Motor is superseded as follows:

(1.1) Electric Motor

Length	16.58 in. (42.11 cm)
Width	5.59 in. (14.46 cm)
Height	6.34 in. (16.10 cm)
Weight	86.5 lb. (39.32 kg)
Input	24 Vdc
Rated current (at 1.5 hp load)	55A
Rated Speed (with motor at 35° C)	3600 rpm
Operating speed	3100 rpm

Page 1-7, paragraph 1-5b (8) and figure 1-5.1 are deleted.

Page 2-1, paragraph 2-1a (5) is superseded as follows:

(5) For the Gasoline Engine Driven Unit, turn the engine with the starter rope to make sure all moving parts are free.

Page 2-1, paragraph 2-3a. In lines 8, 9 and 10, delete "and in the 2½ ton 6x6 cargo trucks M-35 and M-211."

Page 2-1, paragraph 2-3b(2). In lines 2 and 3, delete "or on 2½ ton cargo trucks, against rear end of truck body."

Page 2-9, paragraph 2-7. The third line is changed to read "figures 2-1 through 2-1.5."

Page 2-10 and 2-11. Figure 2-5 and 2-5.1 are superseded by figures 2-5 through 2-5.5.

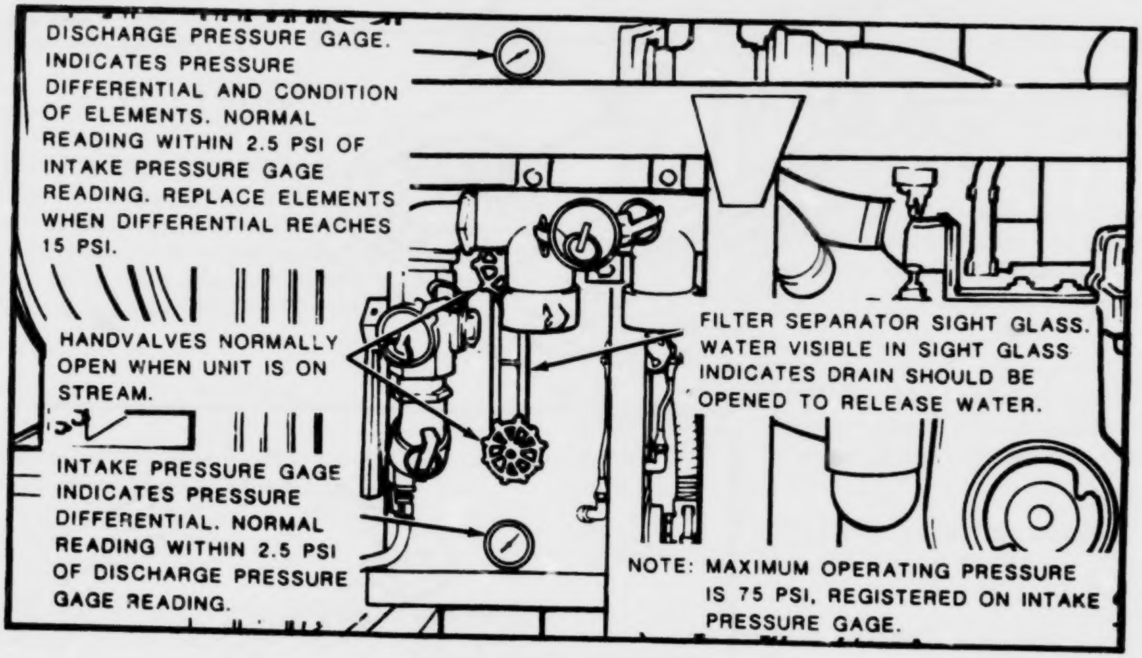

DISCHARGE PRESSURE GAGE. INDICATES PRESSURE DIFFERENTIAL AND CONDITION OF ELEMENTS. NORMAL READING WITHIN 2.5 PSI OF INTAKE PRESSURE GAGE READING. REPLACE ELEMENTS WHEN DIFFERENTIAL REACHES 15 PSI.
HANDVALVES NORMALLY OPEN WHEN UNIT IS ON STREAM.
INTAKE PRESSURE GAGE INDICATES PRESSURE DIFFERENTIAL. NORMAL READING WITHIN 2.5 PSI OF DISCHARGE PRESSURE GAGE READING.
FILTER SEPARATOR SIGHT GLASS. WATER VISIBLE IN SIGHT GLASS INDICATES DRAIN SHOULD BE OPENED TO RELEASE WATER.
NOTE: MAXIMUM OPERATING PRESSURE IS 75 PSI, REGISTERED ON INTAKE PRESSURE GAGE.

Figure 2-5. Pressure Gages and Sight Glass.

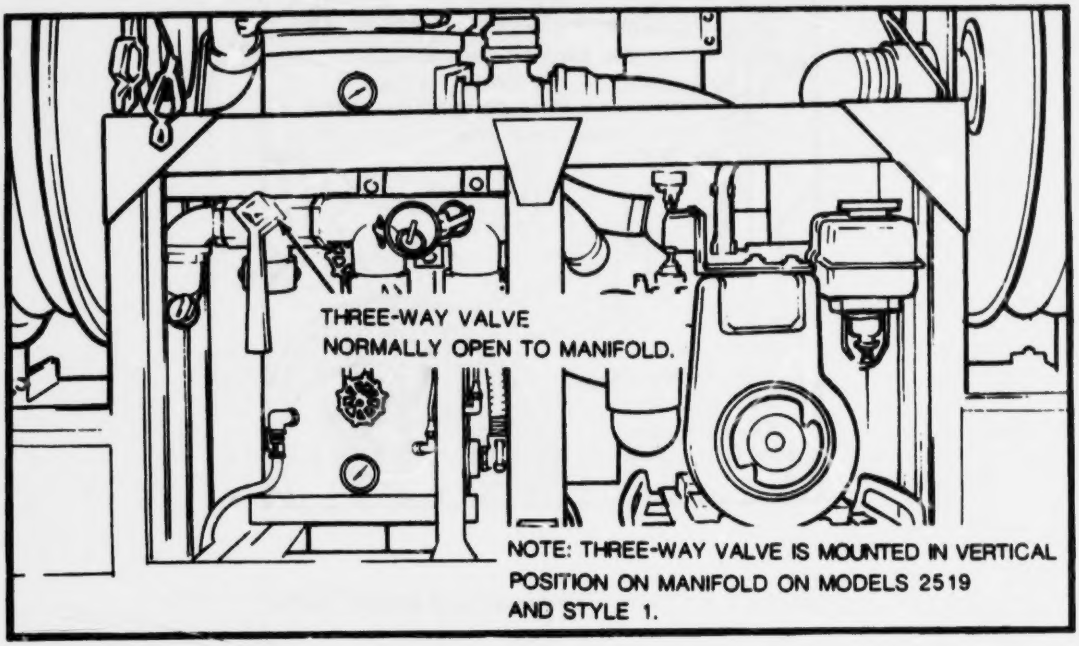

THREE-WAY VALVE
NORMALLY OPEN TO MANIFOLD.
NOTE: THREE-WAY VALVE IS MOUNTED IN VERTICAL
POSITION ON MANIFOLD ON MODELS 2519
AND STYLE 1.

Figure 2-5.1. Three-way valve (Models 2938 and 36W50).

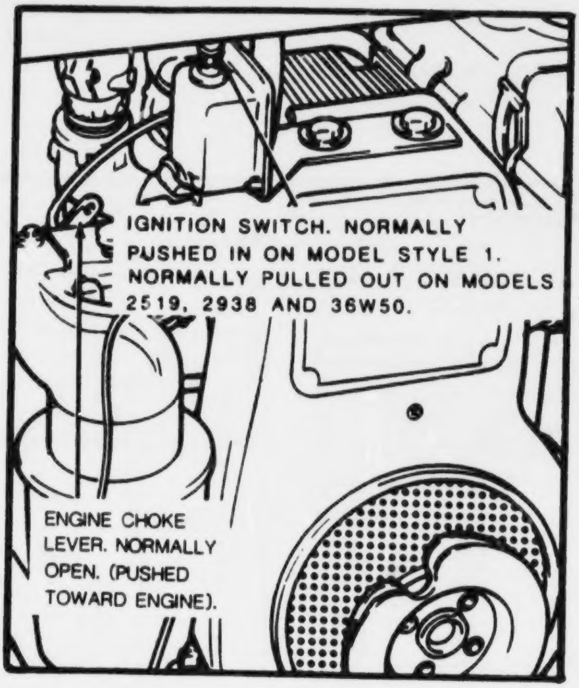

IGNITION SWITCH. NORMALLY PUSHED IN ON MODEL STYLE 1. NORMALLY PULLED OUT ON MODELS 2519, 2938 AND 36W50.
ENGINE CHOKE LEVER. NORMALLY OPEN. (PUSHED TOWARD ENGINE).

Figure 2-5.2. Engine Choke Lever and Ignition Switch.

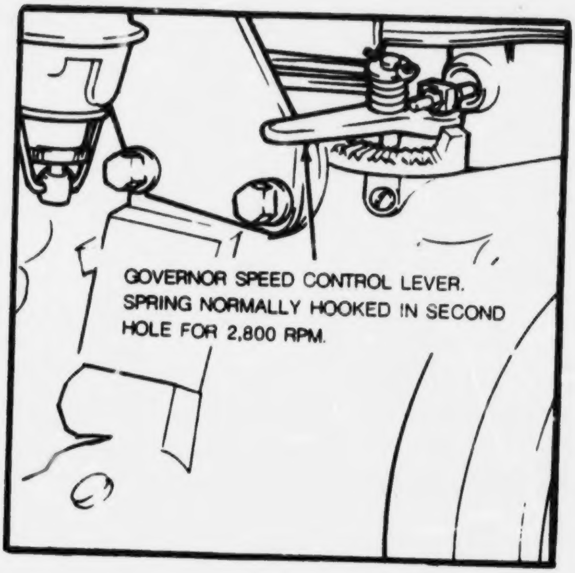

GOVERNOR SPEED CONTROL LEVER. SPRING NORMALLY HOOKED IN SECOND HOLE FOR 2,800 RPM.

Figure 2-5.3. Governor Speed Control Lever.

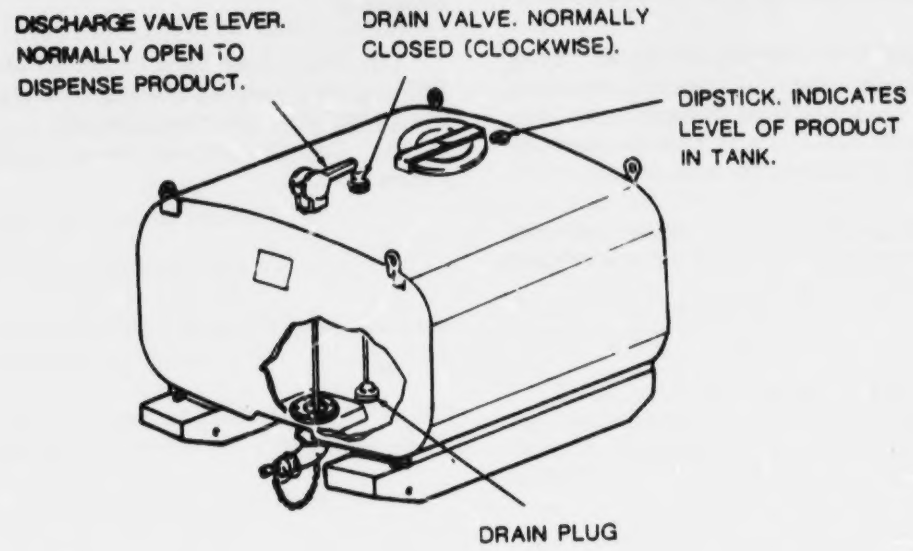

DISCHARGE VALVE LEVER. NORMALLY OPEN TO DISPENSE PRODUCT.
DRAIN VALVE. NORMALLY CLOSED (CLOCKWISE).
DIPSTICK. INDICATES LEVEL OF PRODUCT IN TANK.
DRAIN PLUG

Figure 2-5.4. Tank Dipstick, Drain Valve, and Discharge Valve Lever.

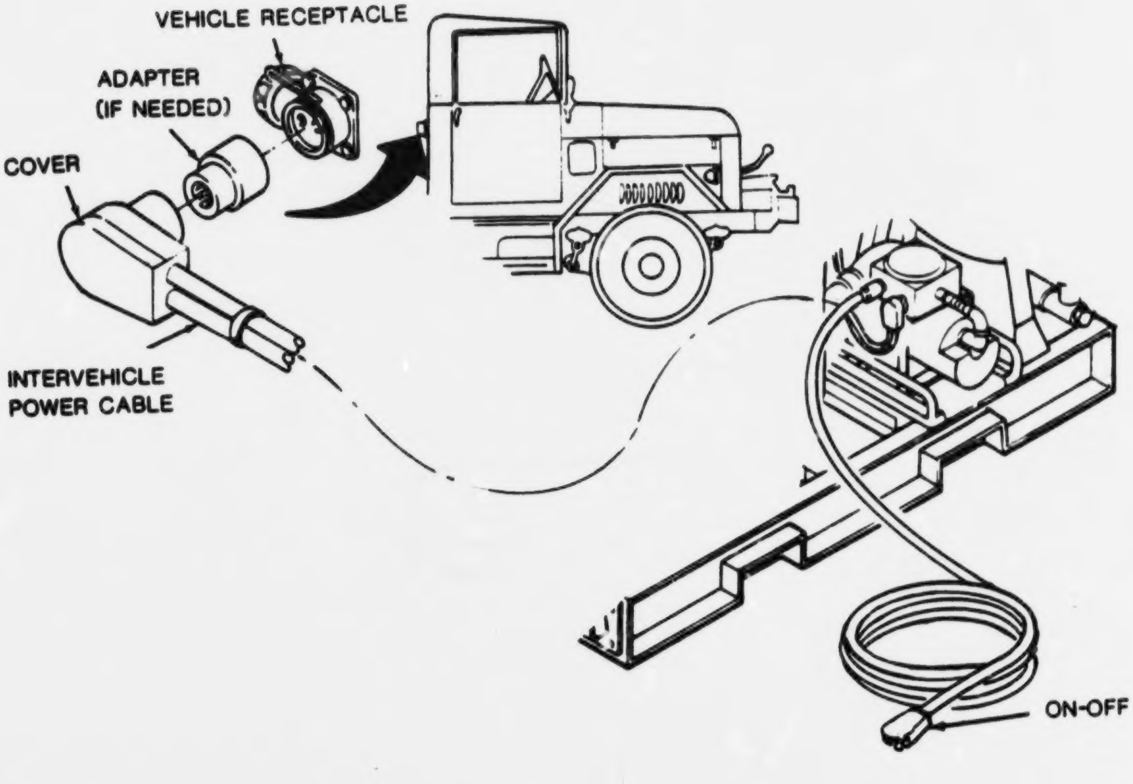

VEHICLE RECEPTACLE
ADAPTER (IF NEEDED)
COVER
INTERVEHICLE POWER CABLE
ON-OFF

Figure 2-5.5. Electric Motor Driven Pumping Assembly.

Page 2-12. After subparagraph 2-9a(8) and note, add subparagraph a(9) as follows:.

(9) To prepare to start electric motor driving pumping assembly, connect intervehicular power cable, with adapter (if needed), to vehicle receptacle and junction box receptacle J2 (Fig 1-4.1). Then connect ON-OFF switch cable to junction box receptacle J1.

Page 2-12, paragraph 2-9c and figure 2-6.1 are superseded by the following paragraph 2-9c and figure 2-6.1:

2-9c Starting Electric Motor Driven Pumping Assembly

(1) Adjust truck hand throttle for proper engi RPM (approximately 1000 RPMs) to maintain adequa charge rate during pumping operation.

(2) Turn ON-OFF switch to on position. Refer Figure 2-6.1.

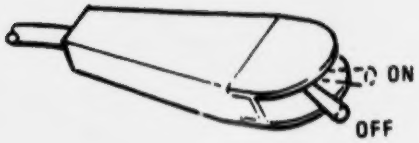


Figure 2-6.1 ON-OFF Switch

Page 2-12, Paragraph 2-10.1 is superseded as follows:

2-10.1. Stopping Electric Motor Driven Pumping Assembly.

a. To stop the electric motor driven pumping assembly, turn the remote pump switch to its off position (Fig. 2-6.2).

b. Reduce hand throttle setting to idle.

c. When moving to a new location:

(1) Disconnect ON-OFF switch cable from junction box receptacle J1 (Fig 1-4.1).

(2) Disconnect intervehicular power cable from vehicle receptacle and junction box receptacle J2.

Page 2-13, paragraph 2-12.d, last line, delete "in cold weather."

Page 2-13. Immediately after paragraph 2-12d, add the following paragraph:

2-12. Electric Motor. Take special precautions to protect equipment in frigid climates or during cold periods. Use care in handling cables and wire insulation. These items become hard and brittle and are easily damaged. Avoid sharp bends or unnecessary loops in cables and wires.

Page 2-14, paragraph 2-13. Add the following subparagraph:

f. Electric Motor. Hot, dry periods subject connectors, receptacles and binding posts to damage from dust and dirt. If possible, operate electric motor in the shade. Make more frequent PMCS.

Page 3-3, Table 3-1. Add the following PMCS procedures:

Table 3-1. Preventive Maintenance Checks and Services.

B—Before operation
D—During operation
A—After operation
W—Weekly
M—Monthly
Q—Quarterly

Item Number	Interval Operator Daily B	D	A	W	Org. M	Q	Item to be inspected	Procedure	Reference
12	X		X		X		Intervehicle Power Cable (EMD)	Check cable assembly and connector for damage. Test for continuity. Replace defective part.	
13	X		X		X		ON-OFF Switch Cable Assembly (EMD)	Check switch for proper operation. Check cable and connector for damage. Replace switch and cable assembly or defective connector.	

WARNING

Disconnect intervehicle cable from vehicle before maintaining or replacing electrical components.

Item Number	Interval Operator Daily B	D	A	W	Org. M	Q	Item to be inspected	Procedure	Reference
14					X		Electric Motor (EMD)	Check for proper connection or loose mounting hardware. Check for proper operation. If monitor is defective, notify Direct Support Maintenance.	
15					X		Electrical Junction Box (EMD)	Check for damaged receptacles, housing or cover gasket. Inspect relay switch inside junction box for loose or corroded terminals and connectors. Clean corroded connections, replace defective parts.	
16							Vehicle Power Supply (EMD)	Check batteries on transporting vehicle to assure adequate power supply for operation of electric motor. (Refer to appropriate TM for transporting vehicle.)	

Page 3-4. Add the following Paragraph 3-8.1 and figure 3-2.1 immediately after paragraph 3-8:

3-8.1 Pump Assembly (EMD)

WARNING

Disconnect intervehicle power cable before maintaining or replacing component parts.

a. The electric motor requires an intervehicular power cable.

(1) Unplug and inspect intervehicle power cable (figure 3-2.1) for damaged or corroded connectors.

(2) Clean connectors to obtain a good connection at J2 connector at Junction Box and connector and adapter at the vehicle receptacle.

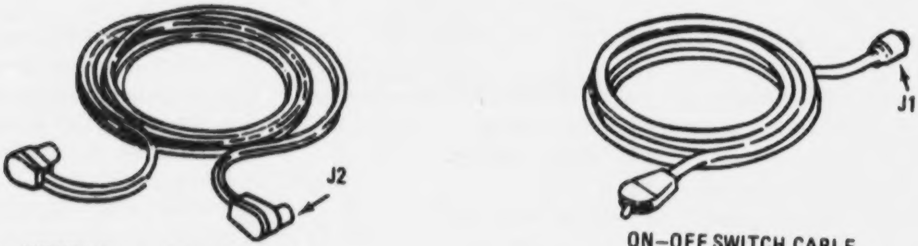
(3) Replace cable assembly if damaged.

b. The electric motor is controlled by an ON-OFF switch cable.

(1) Inspect ON - OFF switch cable (figure 3-2.1) for damage or corroded connectors, damaged or frayed cable, or damaged switch.

(2) If cable or switch are damaged, replace cable assembly.

(3) Remove connectors from J1 receptacle and vehicle receptacle. Install new cable in reverse order. Clean connectors to obtain a good connection at J1 connector at Junction Box. If connector is damaged, notify Organizational Maintenance for replacement.



INTERVEHICLE POWER CABLE

ON–OFF SWITCH CABLE

Figure 3-2.1 Pump Assembly Cables.

Page 3-6 and 3-7, Table 3-2. Troubleshooting is superseded by "Table 3-2.1 Troubleshooting."

Table 3-2.1 Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine hard to start or fails to start	a. Fuel tank empty	a. Fill fuel tank.
	b. Fuel shutoff valve closed	b. Open valve (para 2-9).
	c. Fuel line obstructed	c. Clean fuel line.
	d. Spark plug defective	d. Replace spark plug (para 3-23).
	e. Air cleaner dirty or too full of oil	e. Service air cleaner (fig. 3-1).
	f. Ignition switch or cable defective	f. Replace defective ignition switch or cable (para 3-23).
	g. Magneto improperly timed or defective	g. Re-time or replace magneto (para 3-24).
	h. Fuel mixture improper	h. Adjust carburetor (para 3-28).
2. Engine misses, operates erratically or loses power	a. Fuel mixture improper	a. Adjust carburetor (para 3-28).
	b. Magneto improperly adjusted or defective	b. Adjust or replace magneto (para 3-24).
	c. Choke partially closed	c. Open choke (para 2-7).
	d. Muffler clogged	d. Clean or replace muffler (para 3-31).
	e. Spark plug loose, dirty or damaged	e. Tighten, clean or replace spark plug (para 3-23).
	f. Governor controls loose or improperly adjusted	f. Tighten and adjust governor control (para 3-29).
	g. Other causes	g. Refer other causes to direct support maintenance.
a. Engine overheats or knocks	a. Ventilation across engine poor	a. Provide proper ventilation.
	b. Engine dirty	b. Clean engine radiation fins.
	c. Muffler clogged	c. Clean or replace muffler (para 3-31).
	d. Other causes	d. Refer other causes to direct support maintenance.
4. Engine backfires	a. Fuel mixture too lean	a. Adjust carburetor (para 3-28)
	b. Intake valve sticking	b. Remove spark plug (para 3-23). Pour ½ to 1 oz of penetrating oil (VV-P-216) into cylinder. Let stand 5 minutes and manually crank engine. If intake valve remains stuck, refer to direct support maintenance.
5. Engine exhaust smoke excessive	a. Choke partially closed	a. Open choke (para 2-7).
	b. Fuel mixture too rich	b. Adjust carburetor (para 3-28).
	c. Carburetor float sticking or leaking	c. Replace carburetor (para 3-28).
	d. Air cleaner dirty or too full	d. Service air cleaner (fig. 3-1).
6. Pump fails to operate	a. Leak in suction line	a. Tighten or replace connections or defective hose (para 3-35).
	b. Pump not primed	b. Prime pump (para 2-9).
	c. Impeller damaged or worn	c. Replace impeller (para 3-17).
	d. Engine speed too low	d. Adjust carburetor (para 3-28).

Table 3-2.1. Troubleshooting (Con't)

Malfunction	Probable cause	Corrective action
7. Pump fails to prime	a. Leak in suction lines or connections	a. Replace suction lines. Tighten loose or leaky connections (para 3-35).
	b. Pump chamber not filled	b. Prime pump (para 2-9).
	c. Air leak at mechanical seal	c. Replace seal (para 3-17).
8. Pump will not pump fuel at rated capacity.	a. Low pump engine speed (GED).	a. Adjust engine speed (GED).
	b. Truck engine RPM at improper charge rate (EMD).	b. Adjust engine RPM to approximately 1000 RPMS (EMD).
	c. 600 gal fuel tank may be empty.	c. Fill tank if empty.
	d. Tank cam lever may not be fully open.	d. Open cam lever.

WARNING

Disconnect Intervehicle Power Cable from vehicle before maintaining or replacing electrical components.

Malfunction	Probable cause	Corrective action
9. Electric motor will not operate.	a. Vehicle power supply	a. Insure vehicle batteries and charging system are operating properly.
	b. Power cables	b. Test for continuity or intervehicle cable and ON-OFF switch cable.

WARNING

Disconnect Power Cable

Malfunction	Probable cause	Corrective action
	c. Electric Motor	c. Check electric motor: 1. Remove junction box cover. 2. Remove 3 screws holding K1 Relay and RFI filter to floor of junction box. 3. Carefully lift K1 Relay out of junction box (with all leads attached). 4. Remove 4 screws from RFI cover and remove cover. 5. Disconnect both "TH" leads from RFI filter terminals 2 & 3. 6. Multimeter should read continuity across both "TH" leads indicating a good thermostic switch in electric motor. 7. If continuity is not recorded, replace motor.

WARNING

Make sure all terminals are free of ground.

Table 3-2.1. Troubleshooting (Con't)

Malfunction	Probable cause	Corrective action
		8. Connect power cable and turn remote cable "ON". 9. Battery voltage should be read across RFI filter terminals 1 and 3. 10. If full battery voltage is present, replace electric motor. 11. If anything less than battery voltage is recorded, check RFI filter.
10. Pump noisy	a. Foreign matter in pump	a. Clean pump (para 3-17).
	b. Impeller worn or out of alinement	b. Replace impeller (para 3-17).
	c. Vibrating on base	c. Check tiedown gear.
11. Hose reel does not turn easily	a. Improper lubrication	a. Lubricate fittings in accordance with LO 5-4930-227-12.
	b. Misalined	b. Check alinement.
12. Product discharge is not clean	a. Contaminated elements	a. Replace elements (para 3-9).
	b. Canister loose	b. Tighten canister (para 3-9).
	c. Shell dirty on inside	c. Clean shell.
13. Flow of product slows down during operation	Leak in hose or connections	Tighten connections or replace hose (para 3-35).
14. No product appears in sight glass	a. Upper and lower valves closed	a. Open valves (para 2-7).
	b. Air in sight glass	b. Open petcock to release air (para 2-9).

Page 3-7 Delete Figure 3-3.1 "Interference suppression filter location, removal and installation.

Page 3-7, Paragraph 3-15. The first sentence is changed to read: "The gasoline engine driven pumping assembly is mounted on an aluminum frame that will slide out."

Page 3-7. Paragraph 3-16.1 and Figures 3-4.1 through 3-4.6 is superseded by the following paragraph 3-16.1 and Figure 3-4.1:

3-16.1 Conversion of Gasoline Engine Driven Pumping Assembly to Electric Motor Driven Pumping Assembly.

a. Equipment Removal:

(1) Remove existing suction and discharge hoses from the unit.

(2) Remove existing pump and engine, and attaching hardware from unit.

(3) Remove and dispose of any instruction plate pertaining to the gasoline engine driven pumping assembly from the unit.

b. Installation of Kit:

(1) Remove and retain cable assemblies from the pump assembly.

(2) Install pump assembly (1) using provided 3/8 x 2-inch cap-screws (2) and lock-washers (3).

(3) Assemble tee (4) and coupling halves (5 and 6). Apply antiseize tape to all male pipe threads before assembly.

(4) Remove and retain male cam lock plug from front of manifold and install tee assembly (4, 5, & 6). Install gasket and retained male plug into lower coupling half (6).

(5) Install gasket into female fittings of hose assemblies (7 & 8).

(6) Install 2-inch hose assembly (7) between suction manifold and inlet port on pump.

(7) Install 1½ inch hose assembly (8) between pump discharge and inlet of filter separator.

(8) Install cam lock cap (9) with gasket onto end of manifold fitting.

(9) Reinstall cable assemblies supplied with pump assembly.

(10) Install operating information plate (10) on pump unit frame using the plate as a template, drill 6 mounting holes using a no. 29 (.136) drill. Attach plate using provided drive screws (11).

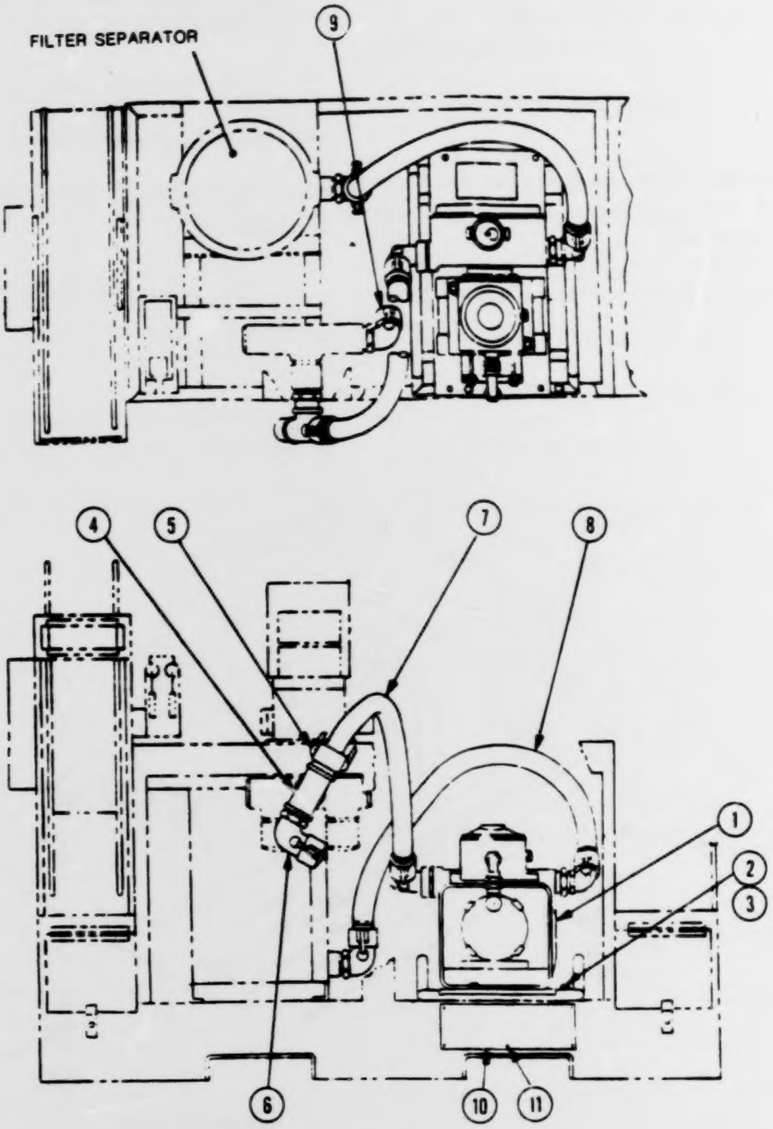


Figure 3-4.1 Conversion of Gasoline Engine Driven Pumping Assembly to Electric Motor Driven Pumping Assembly.

Page 3-9, Paragraph 3-17.1 and Figures 3-6.1 and 3-6.2 are deleted.

Page 3-26. Immediately after figure 3-21, add the following paragraphs and figures:

3-32.1 Pump and Motor Assembly

The pump and motor assembly is mounted on an aluminum frame that will slide out of the pump unit. This mounting arrangement provides easy access to the pump and motor for maintenance and servicing purposes.

a. Removal.

WARNING

Disconnect power before working on the electric motor. Under certain conditions, low voltage causes severe shock or death.

(1) Close dispensing valves on tanks.

(2) Open drain cock on filter/separator. Allow liquid to drain into container.

(3) Pull out on cam arms to disconnect filter/separator-to pump outlet hose from coupling.

(4) Pull out on cam arms to disconnect manifold-to-pump inlet hose from couplings.

NOTE

Manifold-to-pump inlet hose may be hard to remove. If so, leave hose on coupling until pumping assembly is removed.

(5) Remove pump assembly base plate 3-21.1 from A-frame by removing four screws, four lockwashers, four flatwashers and four nuts.

(6) Remove pump drain plug and drain pump volute.

(7) Lift pump assembly with base from frame.

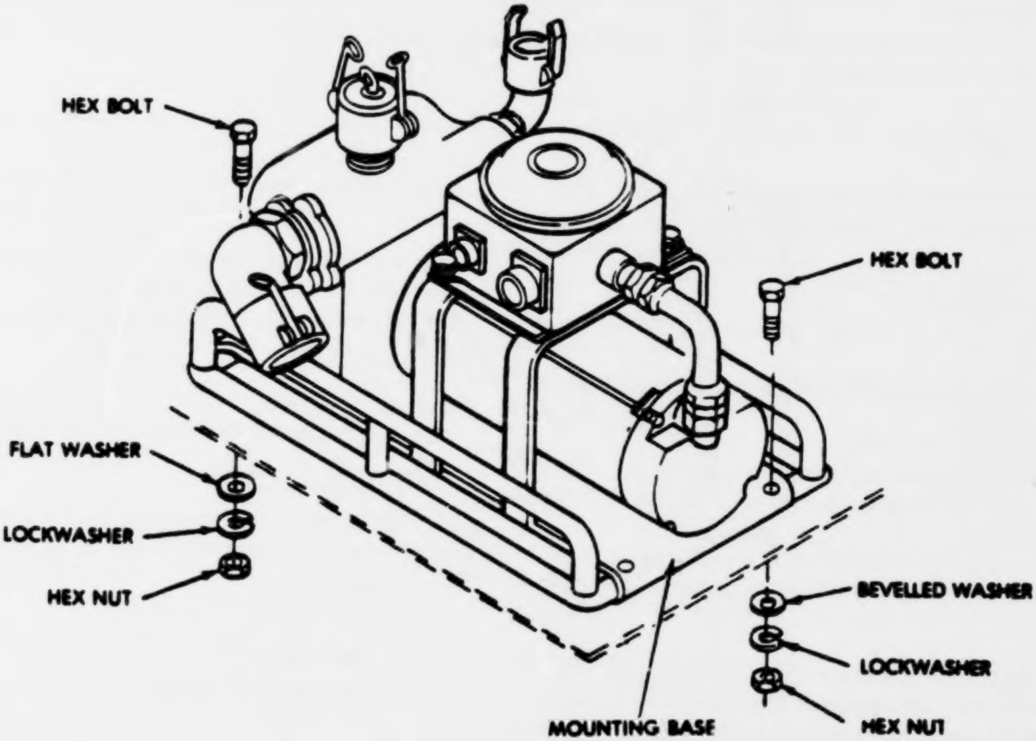


Figure 3-21.1 Pump and Electric Motor Assembly.

(8) To remove pump and motor from base plate first remove four hex bolts, lockwashers, flat washers, and hex nuts.

b. Installation.

(1) Install the pump and motor unit on the mounting base (figure 3-21.1) and secure the mounting brackets to the base with four screws, lockwashers, flat washers and nuts.

(2) Ensure that the drain plug is installed in the pump and tightened.

(3) Install the manifold-to-pump inlet hose on the pump inlet and secure by pushing in on the cam arms.

(4) Position the pump assembly on the frame and secure with four screws, four lockwashers, four flat washers and four nuts.

(5) Install other end of manifold-to-pump inlet hose on the manifold coupling and secure by pushing in on cam arms.

(6) Install filter/separator-to-pump outlet hose on couplings and secure by pushing in on cam arms.

(7) Close drain cock on filter/separator.

(8) Turn lock on vent valve to close position.

(9) Open dispensing valves on tanks.

3-32.2 ON-OFF Switch Cable, J1.

a. Test for continuity.

(1) Use multimeter with switch in the ON position.

(2) If reading is other than 0 ohms, replace cable or defective connector.

b. Connector Removal.

(1) Loosen Screws.

(2) Unscrew connector.

(3) Tag and unsolder leads.

c. Connector Replacement.

(1) Solder leads. Use solder.

(2) Tighten connector.

(3) Tighten screws.

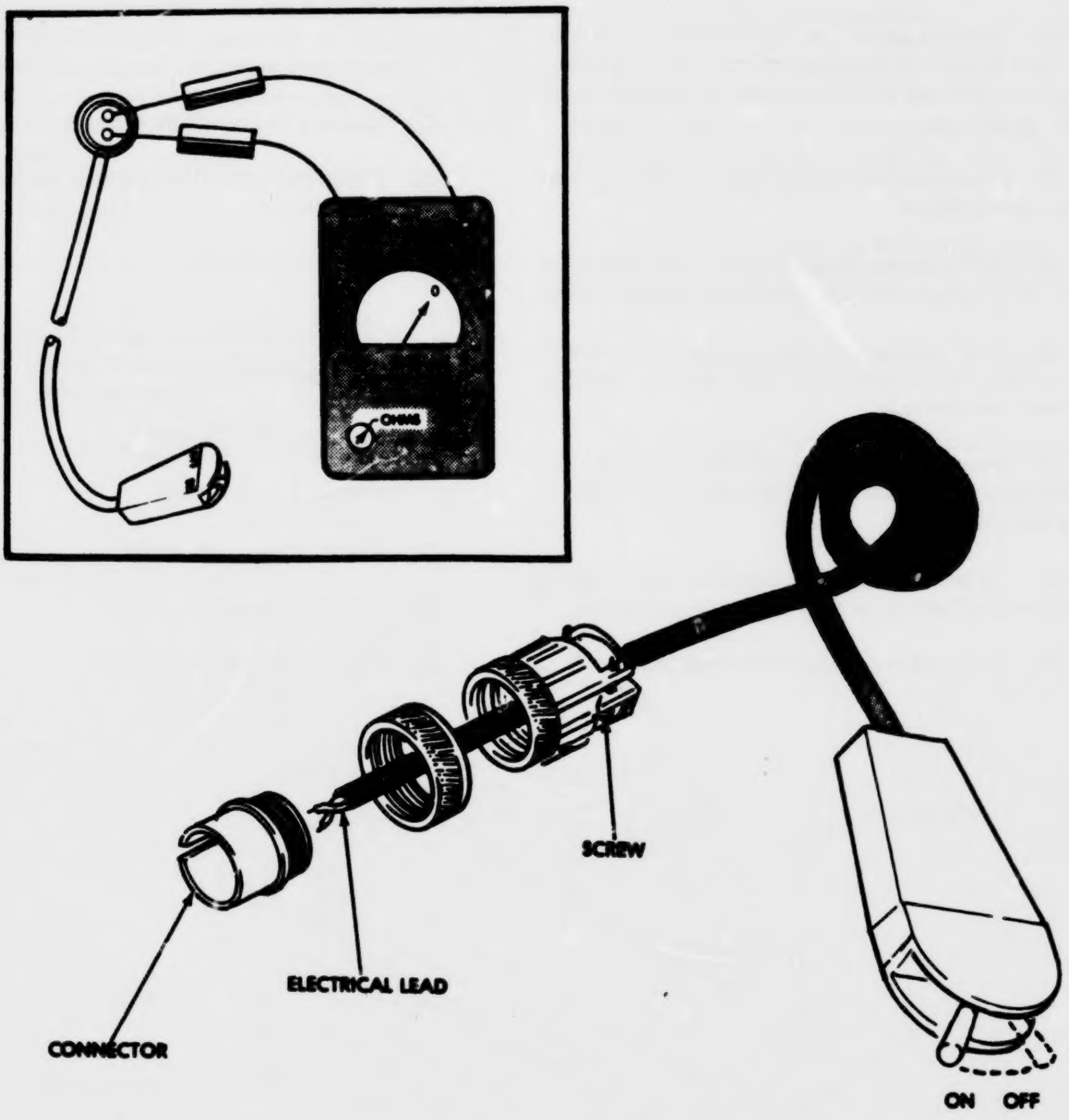

0
OHMS
SCREW
ELECTRICAL LEAD
CONNECTOR
ON
OFF

Figure 3-21.2 ON/OFF Switch Cable.

3-32.3 Intervehicle Power Cable, J2.

a. Test for continuity.

Use multimeter to check both positive and negative sides of the connector. There should be a zero resistance reading. If the reading is other than 0 ohms, replace defective parts. (See figure 3-21.3)

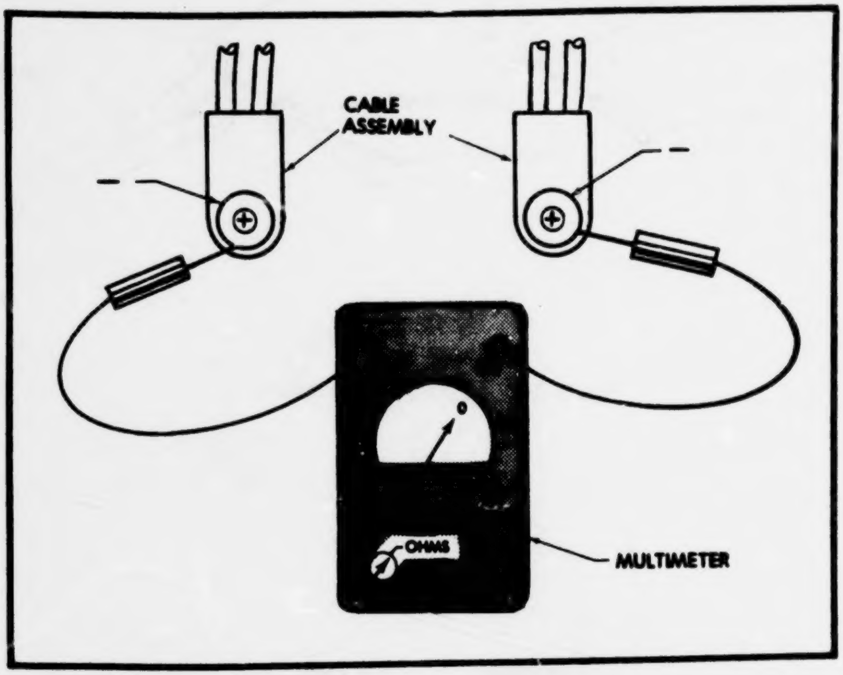


Figure 3-21.3 Test for Continuity.

b. Connector Assembly Removal. (See figure 3-21.4)

(1) Remove the cover from connector by removing screws.

(2) Remove the cables from connector by removing bolt and lockwashers.

c. Connector Assembly Replacement. (See figure 3-21.4)

(1) Attach cables to connector with lockwashers and bolts.

(2) Attach cover to connector with screws.

d. Lug terminal replacement. To replace lug terminals, see figure 3-21.5.

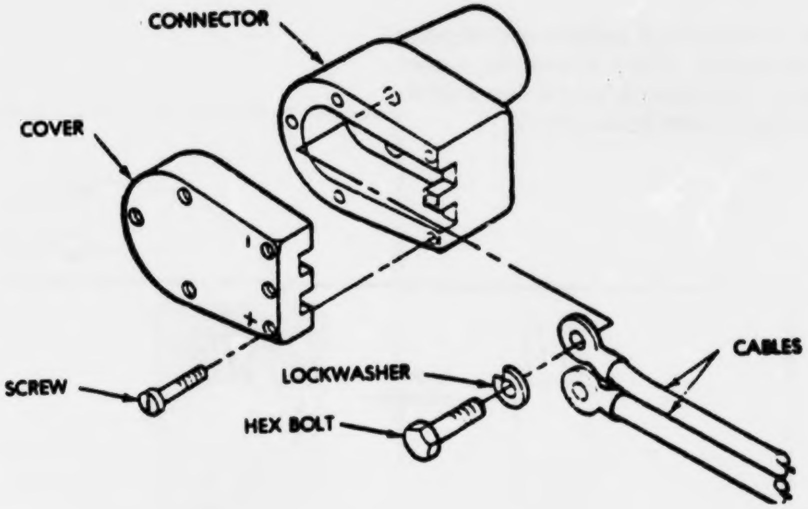

CONNECTOR
COVER
CABLES
SCREW
LOCKWASHER
HEX BOLT

Figure 3-21.4 Connector Assembly.

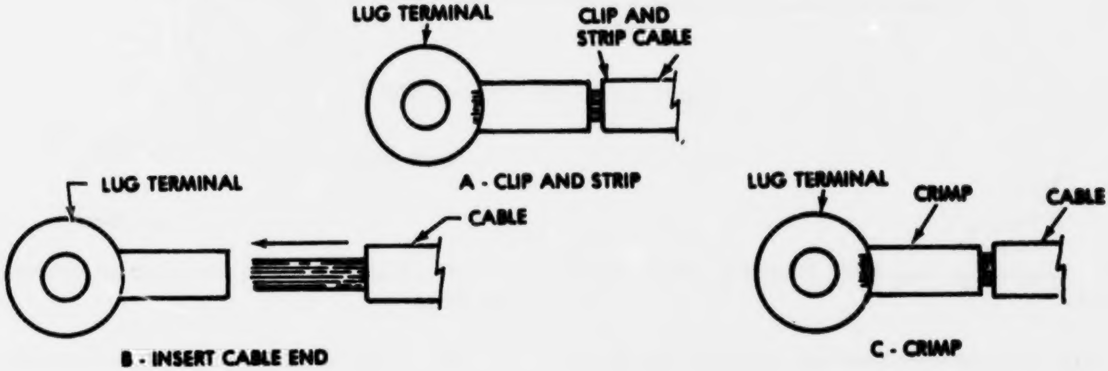

LUG TERMINAL
CLIP AND STRIP CABLE
A - CLIP AND STRIP
LUG TERMINAL
CABLE
B - INSERT CABLE END
LUG TERMINAL
CRIMP
CABLE
C - CRIMP

Figure 3-21.5. Lug Terminal Removal and Replacement.

3-32.4 Conduit Assembly

a. Disassembly.

(1) Disconnect motor electrical leads from RF filter.

(2) Unscrew union from Junction Box.

(3) Unscrew union from motor fitting.

b. Reassembly.

NOTE

Wrap pipe threads once or twice with tape.

(1) Insert fittings over motor electrical leads.

(2) Screw union nuts onto motor and Junction Box fittings.

(3) Reconnect motor electrical leads to connector J2 (See figure 3-21.7)

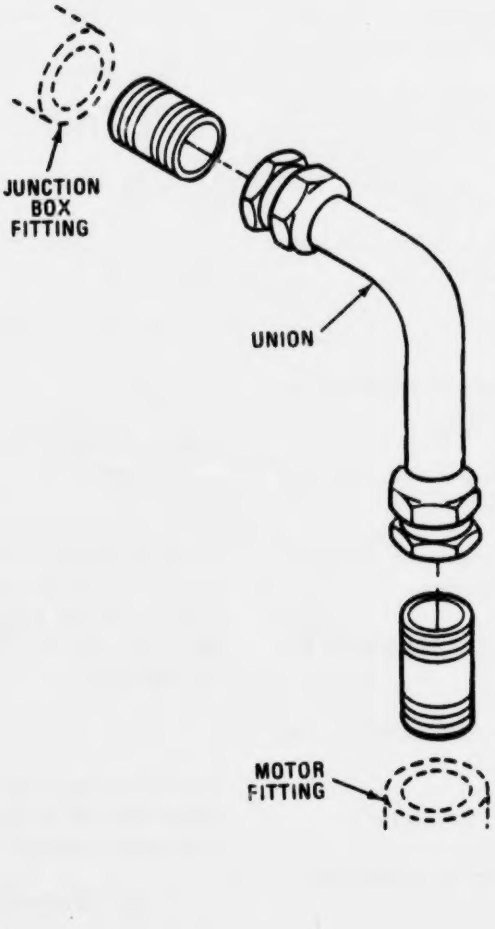


Figure 3-21.6. Conduit Assembly.

3-32.5 Junction Box Assembly

a. Disassembly.

(1) Remove cover and gasket from junction box.

(2) Tag and remove elctrical leads.

(3) Tag and remove electrical leads from connector J2.

(4) Tag and unsolder electrical leads from connector J1.

(5) Disassemble conduit assembly.

(6) Remove hex bolts, hex nuts, lockwashers, and flat washers holding junction box to mount.

(7) Remove screws, lockwashers, and flat washers holding connector J2 to junction box. Insulator and gasket should be removed with connector J2.

(8) Remove screws, lockwashers, and flat washers holding connector J1 to junction box.

b. Reassembly.

(1) Attach connector J1 to junction box with screws, lockwashers, and flat washers.

NOTE

Insure that insulator and gasket are seated on connector J2.

(2) Attach connector J2 to junction box with screws, lockwashers, and flat washers.

(3) Attach junction box to mount with hex bolts, hex huts, lockwashers, and flat washers.

(4) Reassemble conduit assembly (paragraph 3-21.4)

(5) Solder electrical leads to connector J1. Use solder.

(6) Attach electrical leads to connector J2.

(7) Replace cover and O-ring on junction box.

NOTE

- **The electric motor lead identification marking varies depending on manufacturer. (Refer to Figure 3-21.7)**
- **When replacing the electric motor on the pumping assembly (refer to installation instructions and wiring diagram), rotation of the motor clockwise may result (viewing from the impeller end). The correct rotation is counterclockwise.**
- **To change the rotation from clockwise to counter clockwise , switch the two leads marked A1, with the two leads marked A2. These leads are attached to the RFI filter terminals marked #1 and #3.**
- **The leads marked TH are to remain as shown in the wiring diagram.**

c. K-1 Relay Test Procedures.

(1) Step 1.

(a) Place ON-OFF switch in OFF position.

(b) Disconnect Power Cable (J2).

(c) Unscrew and remove Junction Box Cover with O-ring.

(2) Step 2. (See figure 3-21.8)

NOTE

Failure of Motor Thermostatic Switch can prevent relay operation.

(a) The "X" circuit or the relay is grounded through the thermostatic switch in the motor. To check continuity, put probe on "X2" terminal of relay, and other probe on negative (-) terminal of the J2 Connector. (See wiring diagram in figure 3-21.7 for wire connections.)

CAUTION

The following tests require the power cable, J2, be connected as in normal pumping procedure. Exercise care in use of multimeter test probes.

(b) Connect Power Cable (J2).

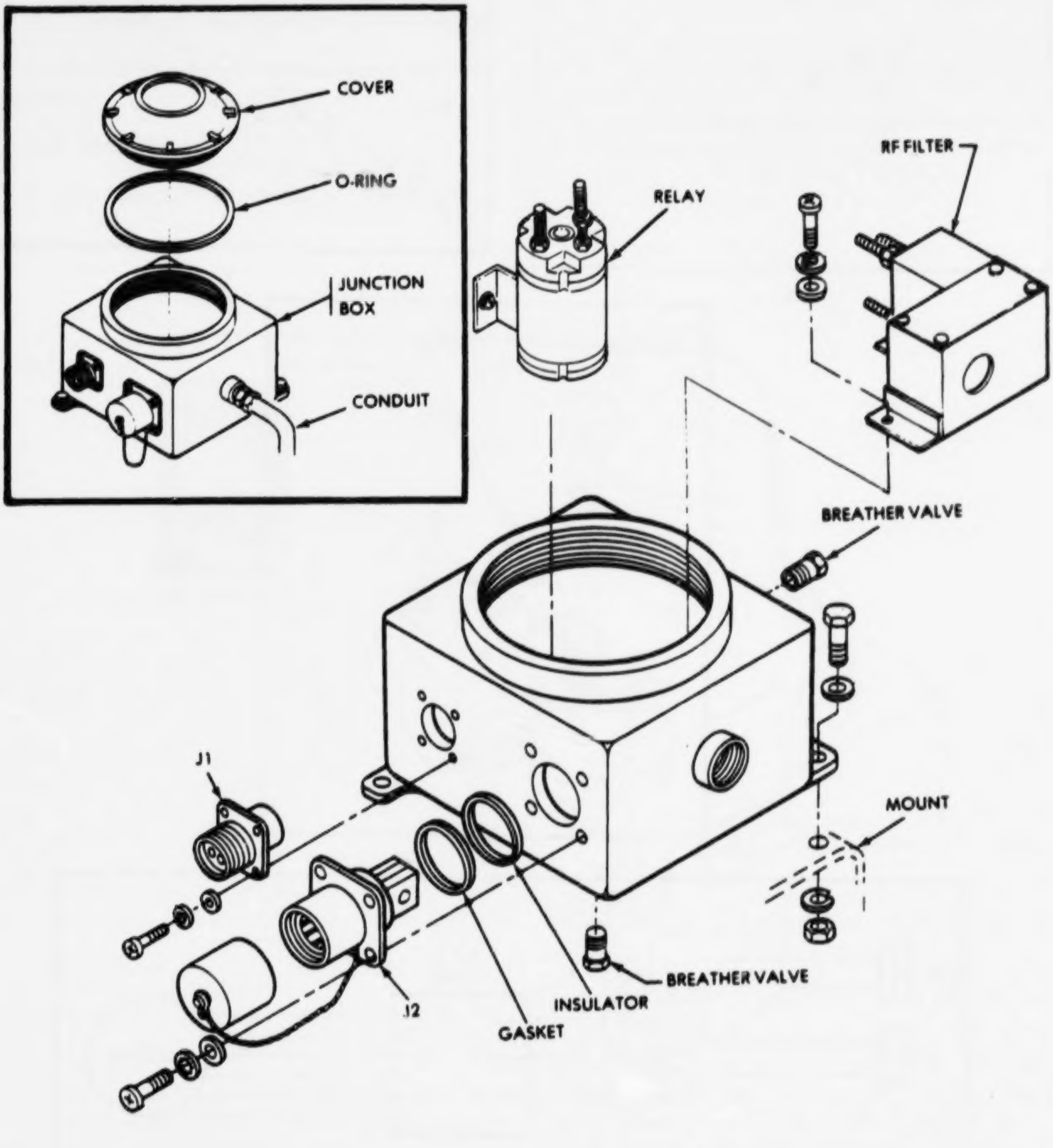

COVER
O-RING
JUNCTION BOX
CONDUIT
RELAY
RF FILTER
BREATHER VALVE
J1
MOUNT
BREATHER VALVE
INSULATOR
J2
GASKET

Figure 3-21.7. Junction Box Assembly (Sheet 1 of 2).

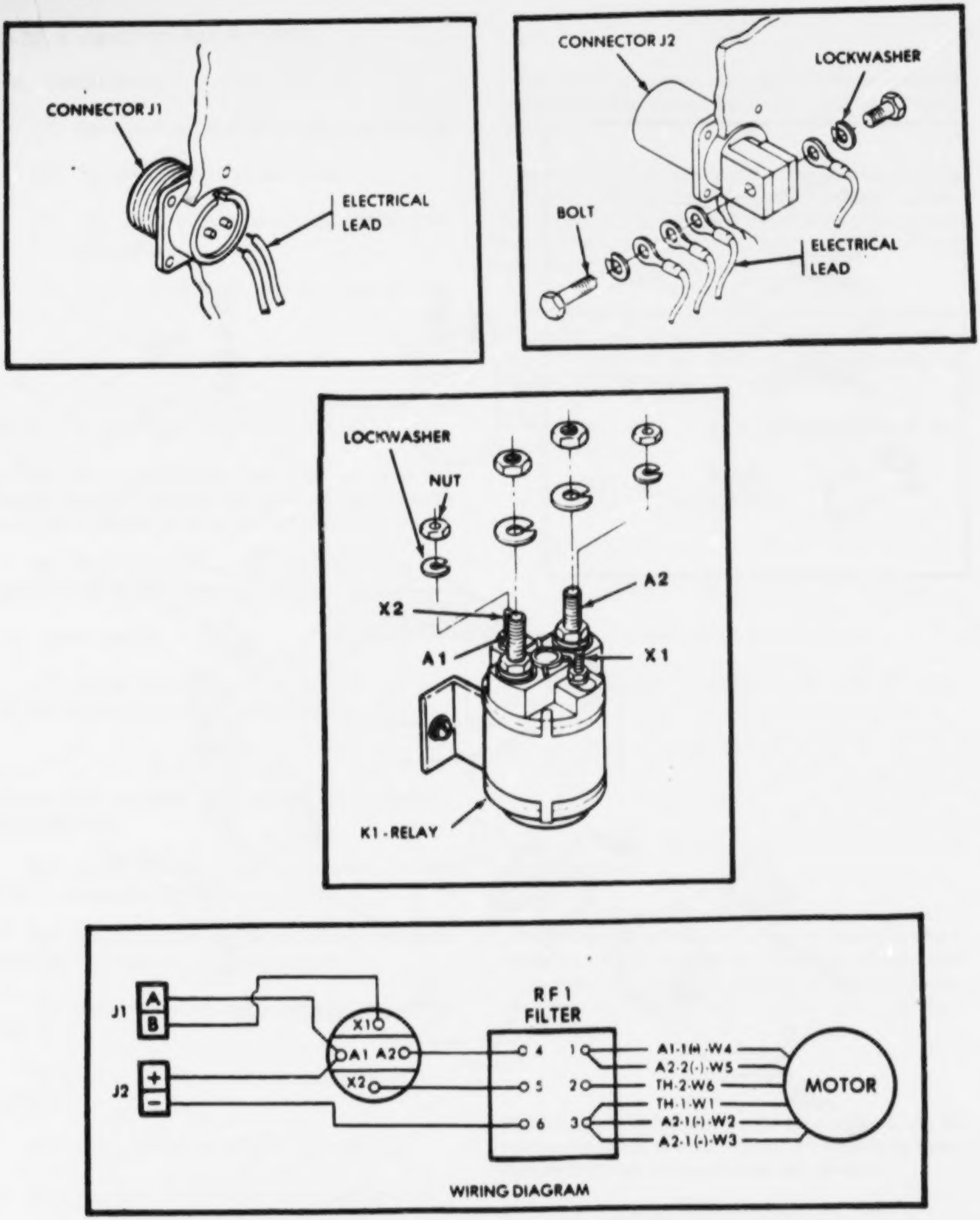

CONNECTOR J1
ELECTRICAL
LEAD
CONNECTOR J2
LOCKWASHER
BOLT
ELECTRICAL
LEAD
LOCKWASHER
NUT
X2
A1
A2
X1
K1 - RELAY
J1
A
B
J2
+
−
X1
A1
A2
X2
RF1
FILTER
4
5
6
1
2
3
A1-1(+)-W4
A2-2(-)-W5
TH-2-W6
TH-1-W1
A2-1(-)-W2
A2-1(-)-W3
MOTOR
WIRING DIAGRAM

Figure 3-21.7. Junction Box Assembly (Sheet 2 of 2).

(c) Hold negative (-) probe of multimeter on inner threaded portion of the junction box to ground.

(d) Touching positive (+) probe of multimeter to "A1." Terminal of relay should give 24 Volt reading.

(e) All other relay terminals should have "0" readings.

(3) Step 3

(a) Place ON-OFF Switch in ON position.

(b) Ground negative (-) probe of multimeter.

(c) Touching positive (+) probe of multimeter to "X-1" terminal of relay should give 24 volt reading.

(d) Touching positive (+) probe of multimeter to "A-1" terminal of relay should give 24 volt reading.

(e) Touching positive (+) probe of multimeter to "A-2" terminal of relay should give 24 volt reading.

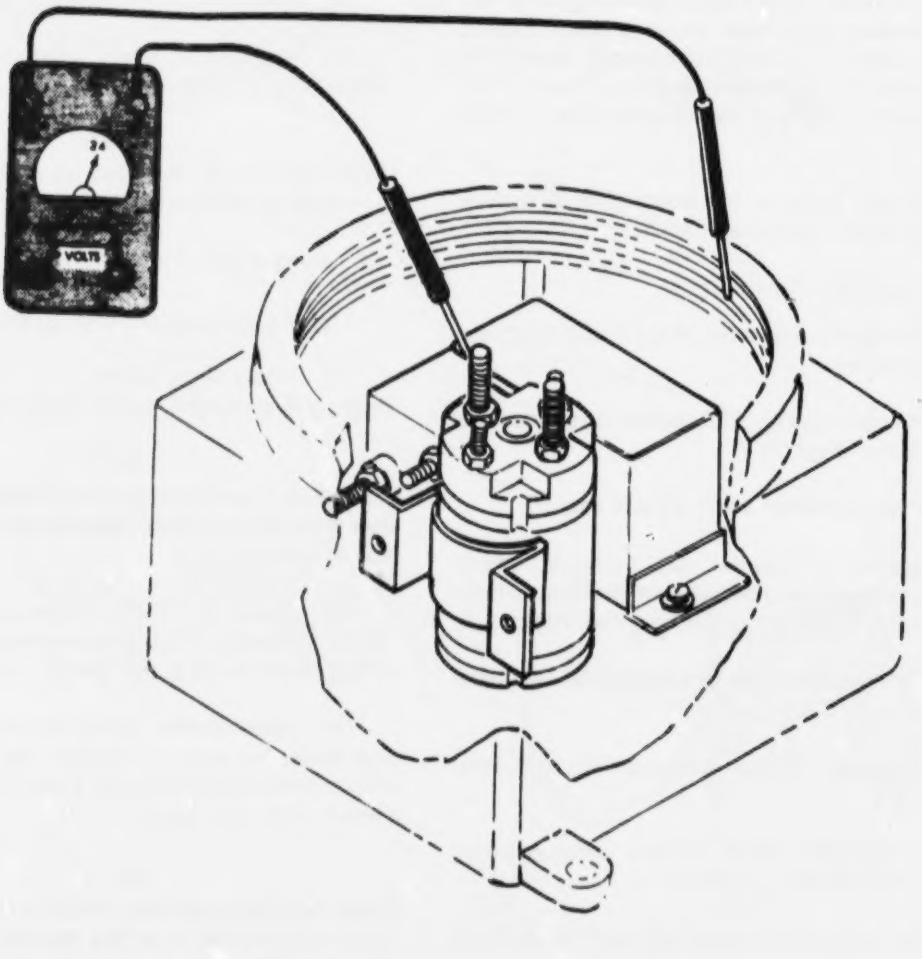


Figure 3-21.8 K-1 Relay Test.

Page 5-2. Paragraphs 5-4e, 5-4f and 5-4g are deleted.

Page 6-4, paragraph 6-8.1 is superseded by the following paragraph 6-8.1:

6-8.1 Centrifugal Pump (Electric Motor Driven)

WARNING

Disconnect intervehicle power cable from vehicle and close tank dispensing valve before maintaining or replacing electrical components; otherwise, electrical sparks could occur, creating a fire hazard.

The pump is a centrifugal-type unit that is directly coupled to the motor. The pump case houses the impeller, wear plate, seal, and adapter shaft, and serves as a liquid chamber with suction and dispensing ports. The check valve assembly consists of a large weight, gasket, and a small weight to prevent fluid backflow through the pump case and thereby retain the prime. Repair of the pump consists primarily of replacing damaged or worn components.

a. Removal. Remove the electric motor driven pumping assembly (paragraph 3-32.1).

b. Disassembly. (figure 6-11.1)

(1) Remove pump drain plug (1) and drain into suitable container.

(2) Remove nuts (2) and washers (3) and remove volute (4) and O-rings (5).

(3) Remove center screw (6) and seal (7).

(4) Remove impeller (8) by unscrewing counterclockwise while holding shaft stationary. Hold armature shaft stationary with screwdriver in slot.

(5) Remove shims (9), screws (10) and wear plate (11).

(6) Remove O-Ring packing (12) and seal assembly (13).

(7) Extract four screws (14) and compression inserts (15), remove pump from motor.

(8) Remove adapter shaft (16) and Woodruff key (17) from motor shaft (18).

(9) Remove nuts (26), suction flange (25), screw (24), small weight (23), gasket (22), large weight (21) and studs (20 and 27) from pump case (19).

c. Cleaning, Inspection and Repair.

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 degrees F - 138 degrees F (38 degrees C - 59 degrees C).

(1) Clean parts with drycleaning solvent.

(2) Dry parts thoroughly.

(3) Inspect the impeller, seal, coupling, and other components for damage or defects.

(4) Replace worn or defective parts.

(5) Replace all seals, gaskets, compression inserts, and O-Rings.

NOTE

ITEMS (5,7,12,13,15) MUST be replaced each time the pump is removed and disassembled.

d. Reassembly (Figure 6-11.1)

(1) Attach studs (20 and 27) to pump case.

(2) Install large weight (21), gasket (22), small weight (23), screw (24), suction flange (25) and nuts (26).

NOTE

Item (15) is a compression insert that will not reseal after once compressed. Replace with new compression inserts.

(3) Install key (17) and attach pump (19) to motor with four screws (14) and new compression inserts (15). Torque evenly to 32 ft. lbs. (36.90 cm. kg).

(4) Install adapter shaft (16) onto armature shaft. Seat stationary seal into Rubber Seal and slide onto adapter shaft and pump cavity. Install Rotating Seal over adapter shaft (see figure 6-11.1)

NOTE

When the Seal, Assembly, Shaft is ordered, an alternative configuration of the Rotating Seal may be received. The uncaged spring and carbon seal is fit and functionally the same as the caged Rotating Seal, and is installed in the same way. An illustration of the Alternate Rotating Seal is included in Figure 6-11.1.

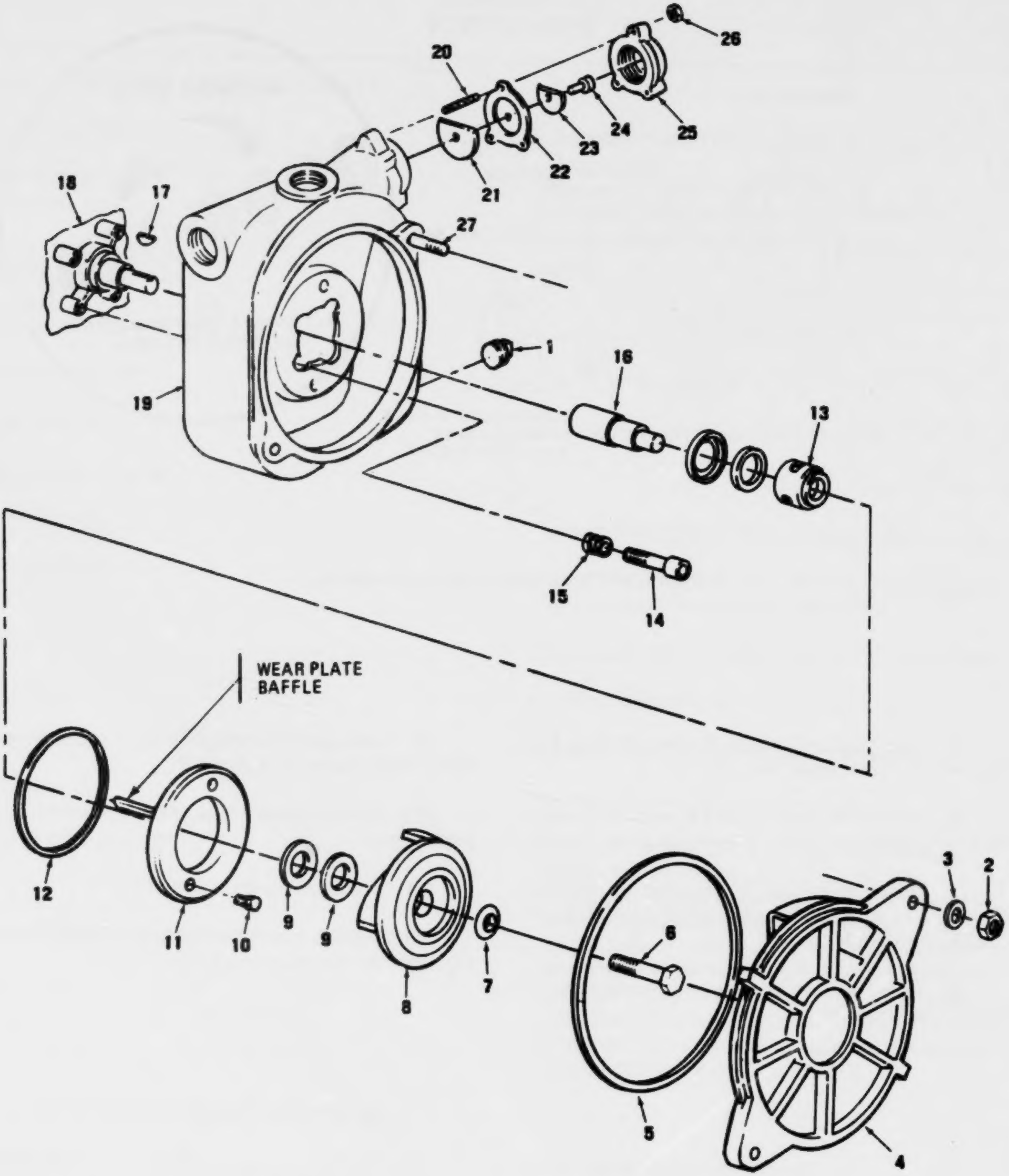

26
20
24
25
23
22
21
18
17
27
1
16
19
13
15
14
WEAR PLATE
BAFFLE
12
11
10
9
9
8
7
6
5
4
3
2

Figure 6-11.1. Centrifugal Pump and Check Valve.

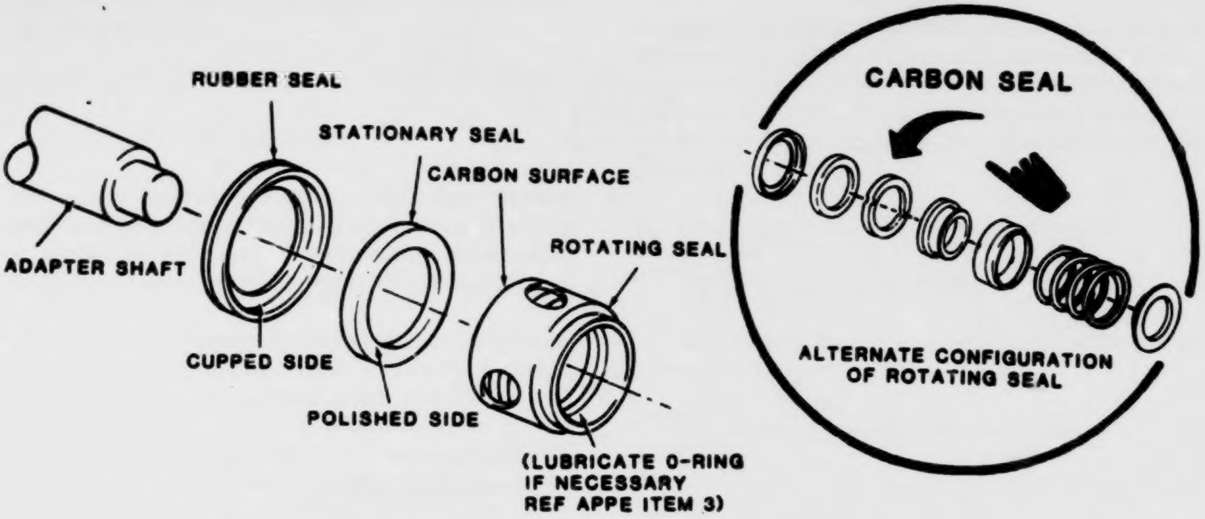

RUBBER SEAL
STATIONARY SEAL
CARBON SURFACE
ROTATING SEAL
ADAPTER SHAFT
CUPPED SIDE
POLISHED SIDE
(LUBRICATE O-RING
IF NECESSARY
REF APPE ITEM 3)
CARBON SEAL
ALTERNATE CONFIGURATION
OF ROTATING SEAL

Figure 6-11.2. Adapter Shaft Seal Assembly.

(5) Lubricate and install O-Ring packing (12, Figure 6-11.1) onto wear plate (11).

(6) Install wear plate (11) and screws (10). (Inspect for bent or defective baffle on back side of wear plate).

(7) Install shims (9) as required to maintain impeller-to-wear plate clearance at 0.010 to 0.015 inch (0.025 to 0.038 CM).

(8) Install impeller (8), new retaining packing (7) and center screw (6).

(9) Lubricate and install O-Ring (5), volute (4) and fasten with washer (3) and nut (2).

(10) Connect inlet elbow, discharge elbow, and priming port.

(11) Install pump drain plug (1).

e. Installation. Install Electric Motor Driven Pumping Assembly (paragraph 3-32.1).

Page A-1, Appendix A is superseded as follows:

APPENDIX A
REFERENCES

A-1. FIRE PROTECTION AND SAFETY

TB5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
TB MED 251	Noise and Conservation of Hearing
TB ORD 1047	Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks

A-2 LUBRICATION

LO 10-4930-204-12	Lubrication Order

A-3. PAINTING

TM 43-0139	Painting Instructions for Army Materiel

A-4. MAINTENANCE

DA PAM 738-750	The Arm Maintenance Management System
TB ORD 1047	Eliminating Combustibles From Interiors of Metal or Plastic Gasoline or Diesel Fuel Tanks
TM9-237	Operator Manual—Welding Theory and Application
FM 10-69	Petroleum Handling Equipment Operations
FM 10-70	Inspecting and Testing Petroleum Products
TM10-1113	Petroleum Tank—Vehicle Operations
TM10-4930-204-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools Lists: Tank and Pump Unit, Liquid Dispensing, For Truck Mounting (United Manufacturing and Engineering Corp. Model Style 1) NSN 4930-00-542-2800, (Model 2519) NSN 4930-00-987-8576, Model 2938) NSN 4930-00-078-4939, (Bowser Inc. Model 36W50) NSN 4930-00-078-4938 (Orr and Sembower Inc. Model BL-100) NSN 4930-00-926-3692 (Altech Inc. Model 4000) NSN 4930-00-926-3581

A-5. RADIO INTERFERENCE SUPPRESSION

TM11-483	Radio Interference Suppression

A-6. DEMOLITION

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy use

Page B-2 Section II Appendix B, The Maintenance Allocation Chart, is superseded as follows:

Section II. MAINTENANCE ALLOCATION CHART

(1)	(2) Function group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
Group No.		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
01	ENGINE													
0100	Engine Assembly:													
	Engine assembly	C	F	C	...	...	...	O	F	H	...	...	....	A
0105	Valve, Camshafts and Timing System:													
	Valves; seat	...	...	...	...	...	...	...	F	F	...	...	....	B
0106	Engine Lubrication System													
	Breather, crankcase	...	...	C	...	...	...	0	...	...	...	...	....	....
02	Pump Motor Assembly	O	O	...	...	...	...	...	O	F	...	...	....	....
	(EMD)	0.5	1.5	...	...	...	...	...	1.0	1.5	...	...	....	....
0201	Electric Motor	...	F	...	...	...	...	...	F	...	...	...	....	....
		...	1.0	...	...	...	...	...	1.5	...	...	...	....	....
0202	Power Cable	C	O	...	...	...	...	...	C	O	...	...	....	....
		0.1	0.5	...	...	...	...	...	0.1	0.5	...	...	....	....
0203	On-Off Switch Cable Assembly	C	O	...	...	...	...	...	C	O	...	...	....	....
		0.1	0.5	...	...	...	...	...	0.1	0.5	...	...	....	....
0204	Junction Box Assembly	...	O	...	...	...	...	...	O	O	...	...	....	....
		...	1.0	...	...	...	...	...	1.0	1.0	...	...	....	....
03	FUEL SYSTEM													
0301	Carburetor:													
	Carburetor	...	...	...	O	...	...	...	O	O	...	...	....	C
0304	Air Cleaner													
	Air cleaner assembly	...	...	C	...	...	...	...	O	...	...	...	....	....
0306	Tanks, Lines, Fittings, Headers:													
	Tank, fuel	...	...	C	...	...	...	...	O	...	...	...	....	....
0309	Fuel Filters:													
	Strainer, sediment	...	...	C	...	...	...	...	O	...	...	...	....	....
06	ELECTRICAL SYSTEM													
	Ignition Components:													
	Magneto, ignition	...	...	...	O	...	...	...	O	O	...	...	....	....
	Spark plug	...	O	O	O	...	...	...	O	...	...	...	....	....
18	BODY, CAB, HOOD AND HULL													
1811	Tank Bodies	...	...	...	...	...	...	...	O	F	...	...	....	....
22	BODY, CHASSIS OR HULL AND ACCESSORY ITEMS													
2202	Accessory Items													
	Hose assemblies	...	F	...	...	...	...	...	O	...	...	...	....	....
	Nozzle	...	...	...	...	...	...	...	O	O	...	...	....	....

Section II. MAINTENANCE ALLOCATION CHART (Continued)

(1) Group No.	(2) Function group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
55	PUMPS													
5500	Pump Assembly:													
	Pump, centrifugal (GED)								O	O				
5600	Pump Centrifugal	O							F	F				
	(EMD)	0.2							2.0	4.0				
5601	Impeller	F							F					
5602	Seal Assembly	F							F					
		1.0							1.5					
76	FIREFIGHTING EQUIPMENT COMPONENTS													
7603	Fire Extinguishers:													
	Fire extinguishers			C					O					

Page C-1. Appendix C is superseded as follows:

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists components of end item and basic issue items for the tank and pump unit to help inventory items for safe and efficient operation.

C-2. GENERAL

The Components of End Item and Basic Issue Items are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the pumping assembly in operation, to operate it, and to perform emergency repairs. Although shipped separately, packaged BII must be with the pumping assembly during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTDE authorization of the end item.

C-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1)—Illustration Number. (Illus Number) This column indicates the number of the illustration in which the item is shown.

b. Column (2)—National Stock Number. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3)—Description. Indicates the National item name and , if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4)—Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5)—Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

APPENDIX C
SECTION II. COMPONENTS OF END ITEMS

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
C-1/1	6150-01-022-6004	Cable Assembly, Power (Electric Motor Driven) (19207) 11682336-1	EA	1
C-1/2	6150-01-191-9732	Cable Assembly, Remote Switch (Electric Motor Driven) (97403) 13217E2964	EA	1

SECTION III. BASIC ISSUE ITEMS

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
C-1/1	4930-01-159-4437	Adapter Assembly, Water Detector (97403) 13220E9406-3	EA	1
C-1/4	4930-01-169-5287	Adapter Probe, Water Detector Kit (97403) 13220E9914-3	EA	1

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted (2000).

Changes in force: C2, C3, C4, C5, C6, C7, C8 and C9

CHANGE
NO. 9

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 April 1988

Operator, Organizational, Direct Support and General Support
Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

TM 5-4930-277-14, 13 June 1969, is changed as follows:

Page 1-1, Para 1-3, is superseded by:

1-3. Administrative Storage

a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.

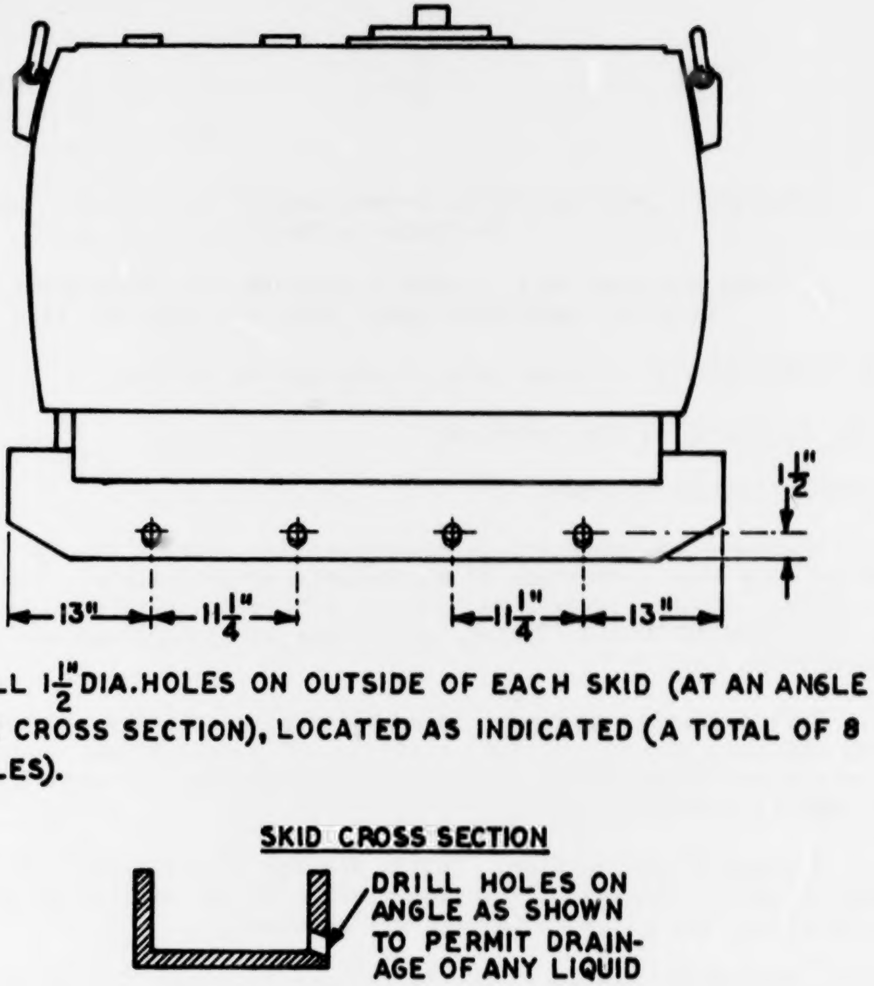
b. Before placing equipment in administrative storage, current maintenance services and equipment serviceable criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWO's) should be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.

Page 2-1. Para 2-3a, sentence four is changed to read, "Section 2 and 3 are also used in the M-54 cargo truck.

Page 2-1, Para 2-3b (2) is changed to read, "Install the two parts of section 2 against section 1."

Page 6-10, Figure 6-12, is superseded as follows:



DRILL 1 1/2" DIA. HOLES ON OUTSIDE OF EACH SKID (AT AN ANGLE SEE CROSS SECTION), LOCATED AS INDICATED (A TOTAL OF 8 HOLES).

DRILL HOLES ON ANGLE AS SHOWN TO PERMIT DRAINAGE OF ANY LIQUID

Fiqure 6-12. Tank Assembly, Skid Drain Holes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Su and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, truck Mounted (2000).

CHANGE
No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 4 November 1986

Operator, Organizational, Direct and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

TM 5-4930-227-14, dated 13 June 1969, is changed as follows:

Throughout this manual change TM 38-750 to read DA Pam 738-750.

Page 1-1. Paragraph 1-2. b. line 6, change U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, MO. 63120 to read: US Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798.

Page 3-3. Paragraph 3-6. b. is changed to read "The interval column tells you when to perform a certain check or service."

Page 3-3. Paragraph 3-6. c. is changed to read:

c. Leakage definitions for operator/crew PMCS shall be classified as follows:

Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or organizational maintenance.

Table 3-1 is replaced by Table 3-1 and 3-2.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

NOTE

Within designated interval, these checks are to be performed in the order listed.

B-Before D-During A-After

Item No.	Interval			Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is Not Ready/ Available if:
	B	D	A			
					NOTE Perform lubrication prior to or in conjunction with before PMCS. Refer to LO 5-4320-227-12. Keep the engine and pump free of dirt and oil on all external surfaces.	
1	●			Tank and Pump Unit	Make the following walk around checks:	
					a. Inspect engine, pump, tanks, and reel assemblies for evidence of leakage (oil and fuel) on, around, or under the unit.	Class III oil leaks or any fuel leakage found.
					b. Check for loose, damaged, or missing hardware and parts.	Missing engine shrouding or broken sight glass on the separator.
					c. Check grounding cables for broken cables or clips and for corrosion.	Corroded or broken cables or clips.
					NOTE During starting and operation check for unusual noise, rough running, lack of power, excessive smoke, and loss of power. Check for fuel, oil, or exhaust leaks. Check for any indication of a failing or defective component.	

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services--continued

B-Before D-During A-After

Item No.	Interval B	Interval D	Interval A	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is Not Ready/ Available if:
2		●		Filter/ Separator	Monitor as follows: a. Check signt glass and drain water as required. b. Check discharge (upper) gage and inlet (lower) gage. Replace filter elements when discharge (upper) gage indicates 20 psi less than inlet (lower) gage with engine at full throttle and both nozzles open. (para 3-34).	
3			●	Engine Fuel Tank	WARNING Do not fill fuel tank when engine is running or hot. Fill fuel tank.	

Table 3-2. Organizational Preventive Maintenance Checks and Services

Q-Quarterly

Item No.	Interval Q	Item to be Inspected	Procedures
1	●	Hoses	Check hoses for breaks, cracks, cuts, and worn areas. Replace damaged hoses. (para 3-35)
2	●	Ground Cables	Check cables for worn or frayed condition. Replace worn or frayed cables. (para 3-37)
3	●	Tank Manhole Assembly	Check as follows: a. Check vent assembly for dirt or damage. Clean or replace dirty or damaged vent assembly. (para 3-42) b. Check for cracked or broken manhole cover gaskets. (para 3-42)

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Organizational, Direct and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted (2000).

CHANGE
No. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 21 February 1987

Operator, Organizational, Direct and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

TM 5-4930-227-14, dated 13 June 1969, is changed as follows:

Page 2-12. Paragraph 2-10 is changed to read:

a. Refer to figure 2-7 and stop the engine.

CAUTION

To prevent damage to sight glass, secure dust caps to all manifold connections.

b. In the event the unit is to be shut down for an extended period of time or to be moved, secure dust caps to all manifold connections. Close both sight glass valves to eliminate loss of fuel during transport.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Organizational, Direct and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted (2000).

URGENT

Changes in force: C2, C3, C4, C5 and C6

TM 5-4930-227-14
*C6

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 22 May 1978

Operator, Organizational, Direct and General Support Maintenance Manual
TANK AND PUMP UNIT, LIQUID DISPENSING, FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000)
NSN 4930-00-877-8678

TM 5-4930-227-14, 13 June 1969, is changed as follows:

Inside Front Cover, add to Safety Precautions:

WARNING

> Prior to welding, read welding instructions contained in Chapter 6, Section II, on maintenance of the Tank Assembly. DEATH or SERIOUS INJURY may result if personnel fail to heed Safety Precaution for welding.

Page 6-10. Paragraph 6-10*a* is superseded as follows:

a. Tanks. No repair will be initiated until the tank has been thoroughly vented and cleaned. Before attempting to do any welding repair on tank, drill four 1/2-inch diameter drain holes in each skid, (total of 8 holes required), and four 1-1/2-inch diameter in each skid, (total of 8 holes required), for location of drilling points (See figure 6-12). A combustible vapor test reading will be taken prior to purging the tank and skids, using an acceptable explosive meter such as MSA Vapor Tester, NSN 6665-00-664-4650 or equivalent. Purge the skid by steam cleaning or other suitable method. Vapor test again and repurge as required after completion of repair provide corrosion protection to drilled holes open. Refer to d below for welding precautions.

Page 6-10. Figure 6-12 is superseded as follows:

---

*This change supersedes Change 1, 24 August 1970.

URGENT

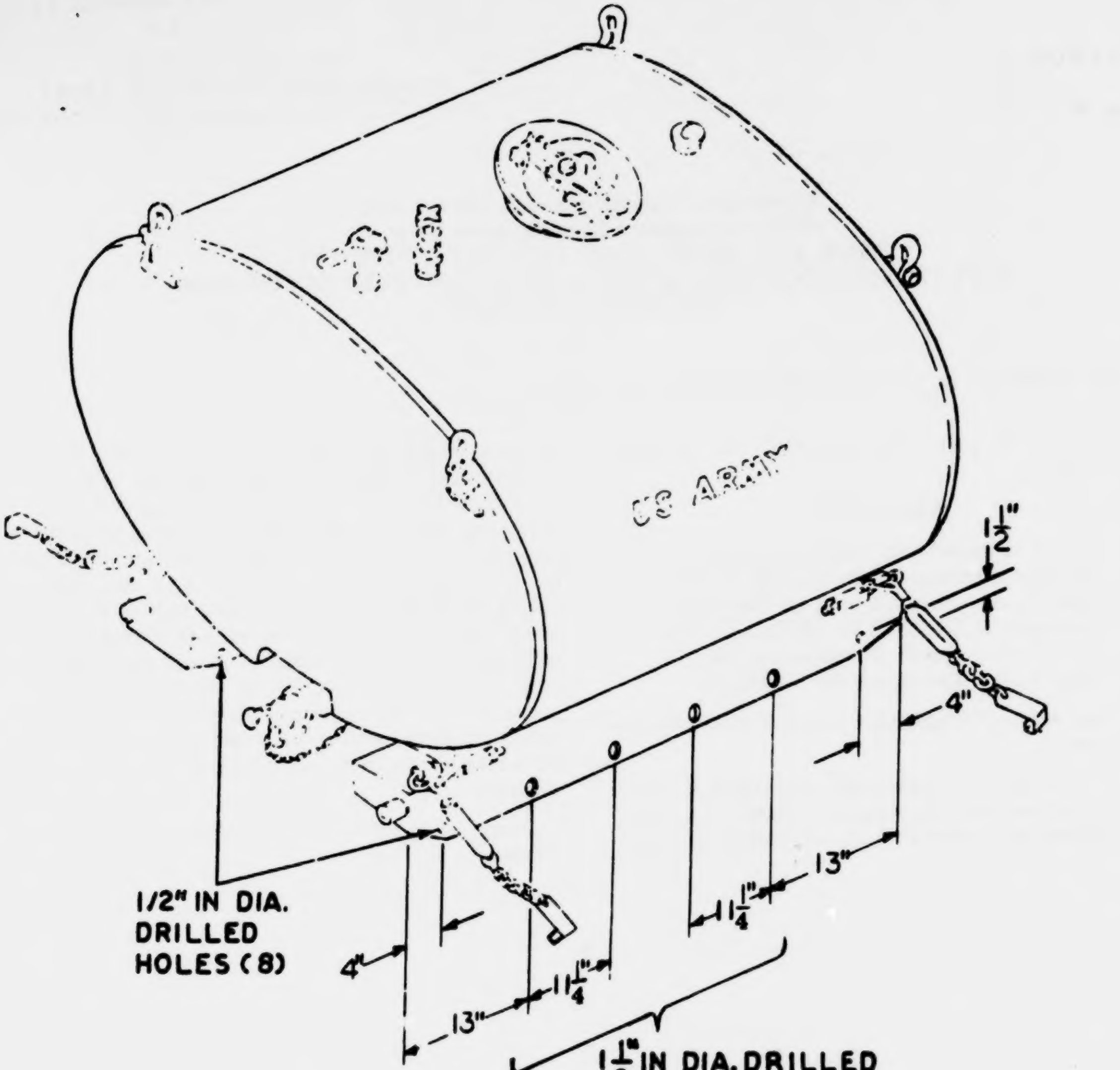

US ARMY
1 1/2"
4"
13"
1 1/4"
1/2" IN DIA.
DRILLED
HOLES (8)
4"
1 1/4"
13"
1 1/2" IN DIA. DRILLED
HOLES (FOUR HOLES
IN OUTSIDE WALL OF
EACH SKID)
TS4930-227-14/6-12,C6

Figure 6-12. Skid drain holes diagram.

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A, operator maintenance requirements for Petroleum Distribution.

Changes in force: C 1, C 2, C 3, C 4, and C 5

TM 5-4930-227-14
C 5

CHANGE }
No. 5 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *22 January 1975*

Operator, Organizational, Direct and General Support Maintenance Manual
TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) NSN 4930-00-877-8678

TM 5-4930-227-14, 13 June 1969, is changed as follows:

The title is changed as shown above.
Page 1-1, paragraph 1-4*a*. Add the following:

CAUTION

Extreme caution should be taken in filling tanks to avoid exceeding cross country payload limits of the transporting vehicle. "(Example, M-34; M-35; and M-211, 2-1/2 ton, 6 x 6 cargo trucks cross country payload is 5000 pounds)."

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Arm
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block No. 154), Organizational maintenanc requirements for Petroleum Distribution.

TM 5-4930-227-14
C 4

Change No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *28 June 1974*

Operator, Organizational, Direct and General Support Maintenance Manual TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

TM 5-4930-227-14, 13 June 1969, is changed as follows:
Inside of Cover, add to Safety Precautions:

WARNING

Prior to welding, read welding instructions contained in Chapter 6, Section II on maintenance of the Tank Assembly. DEATH or SERIOUS INJURY may result if personnel fail to heed Safety Precautions for welding.

WARNING

Cleaning solvent, PD-680, is a POTENTIALLY DANGEROUS CHEMICAL. Do not use near open flame.

Page 3-1, paragraph 3-4, add:

WARNING

Dry cleaning solvent, PD-680, used for cleaning is a POTENTIALLY DANGEROUS CHEMICAL. Do not use near open flame. Flash point is 100° F. - 138° F.

By Order of the Secretary of the Army:

CREIGHTON W. ABRA
General, United States A
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-24A (qty rqr block No. 154) organizational maintenance requirements for Petr
Distribution.

Changes in Force: C 1, C 2, and C 3

CHANGE }
No. 3 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *8 January 1974*

Operator, Organizational Direct and General Support Maintenance Manual
TANK AND PUMP UNIT, LIQUID DISPENSING FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000)
FSN 4930–877–8678

TM 5–4930–227–14; 13 June 1969, is changed as follows:

Page 1–1. Paragraph 1–2.*b* is superseded as follows:

b. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commander US Army Troop Support Command Attn AMSTS–MPP St. Louis, MO 63120.

Paragraph 1–4.a, add the following:
The electric motor driven pump is intended for use in cold weather climates on an "as required" basis.

Page 1–1. After paragraph 1–4*c*, add paragraph 1–4*c*.1:

c.1. *Pump.* The Gorman-Rupp Pump, is a self-priming unit, with the impeller mounting on the extended shaft of the electric motor. Both pump and motor are mounted on a base plate to facilitate removal and use in auxiliary pumping operations.

Page 1–1. After paragraph 1–4.*d* add paragraph 1–4*d*.1.

d.1. *Electric Motor.* The electric motor is explosion-proof. The motor operates on 28 volts *dc* (direct current) and is rated at 1.33 hp (horsepower)

Page 1–6. After paragraph 1–5.*a*(2) add paragraph 1–5.*a*(2.1):

(2.1) *Electric Motor Pump Unit.* Located above motor plate. Specifies the nomenclature, manufacturer, model, serial number and rating.

After paragraph 1–5a(3) add paragraph 1–5*a* (3.1):

(3.1) *Motor Plate.* Located on the unit. Specifies the nomenclature, manufacturer, serial number, and rating.

Paragraph 1–5.b(1), add the following:

(1.1) *Electric Motor*

Manufacturer	Master Electric Division, Reliance Electric and Engineering Co.
Identification No.	X242–3A
Type	Fully-enclosed explosion proof
Speed	3600 rpm
Maximum operating temperature	75°C over 40° ambient
Thermal overload protection	Opens at 20° below maximum operating temperature

Page 1-7. Paragraph 1-5*b*.(8) is added:

(8) *Wiring diagram.* A practical wiring diagram of the electrical system is illustrated in figure 1-5.1.

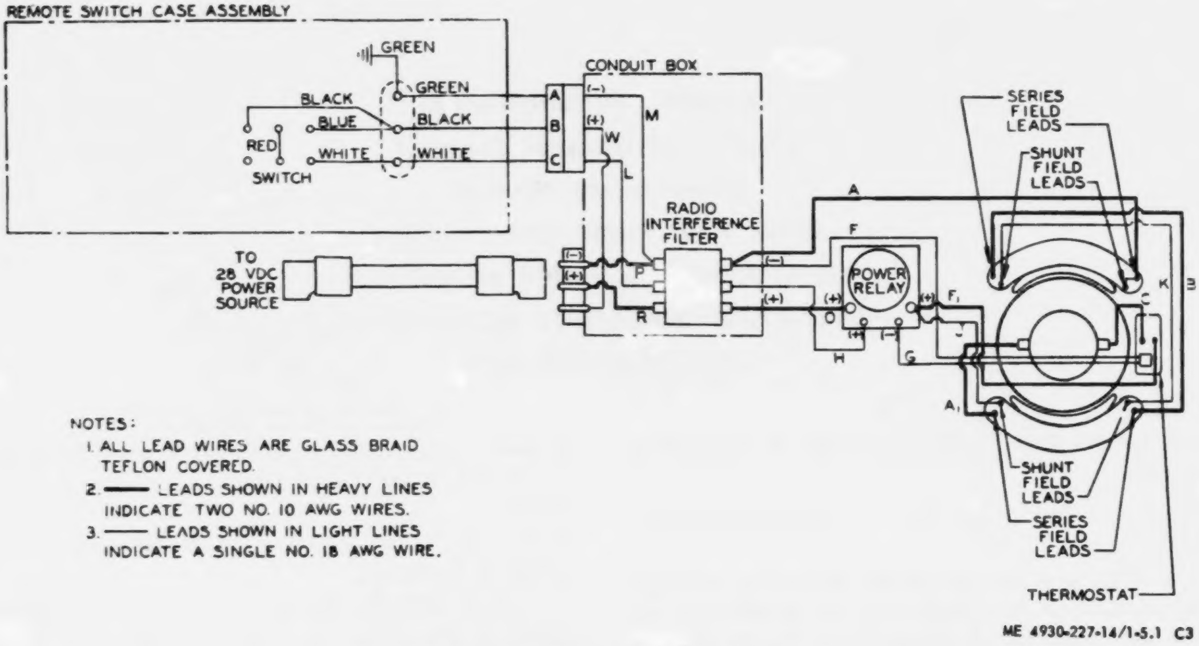

REMOTE SWITCH CASE ASSEMBLY
GREEN
GREEN
BLACK
BLUE
BLACK
RED
WHITE
WHITE
SWITCH
A
B
C
(−)
(+)
CONDUIT BOX
M
W
L
P
R
RADIO INTERFERENCE FILTER
TO 28 VDC POWER SOURCE
(−)
(+)
A
F
(−)
(+)
(+)
POWER RELAY
D
(+)
(−)
H
G
(+)
F1
A1
SERIES FIELD LEADS
SHUNT FIELD LEADS
K
B
C
SHUNT FIELD LEADS
SERIES FIELD LEADS
THERMOSTAT
NOTES:
1. ALL LEAD WIRES ARE GLASS BRAID TEFLON COVERED.
2. LEADS SHOWN IN HEAVY LINES INDICATE TWO NO. 10 AWG WIRES.
3. LEADS SHOWN IN LIGHT LINES INDICATE A SINGLE NO. 18 AWG WIRE.
ME 4930-227-14/1-5.1 C3

Figure 1-5.1. Practical wiring diagram

Page 2-9. Paragraph 2-7. The third line is changed to read "*** in figures 2-5 and 2-5.1."

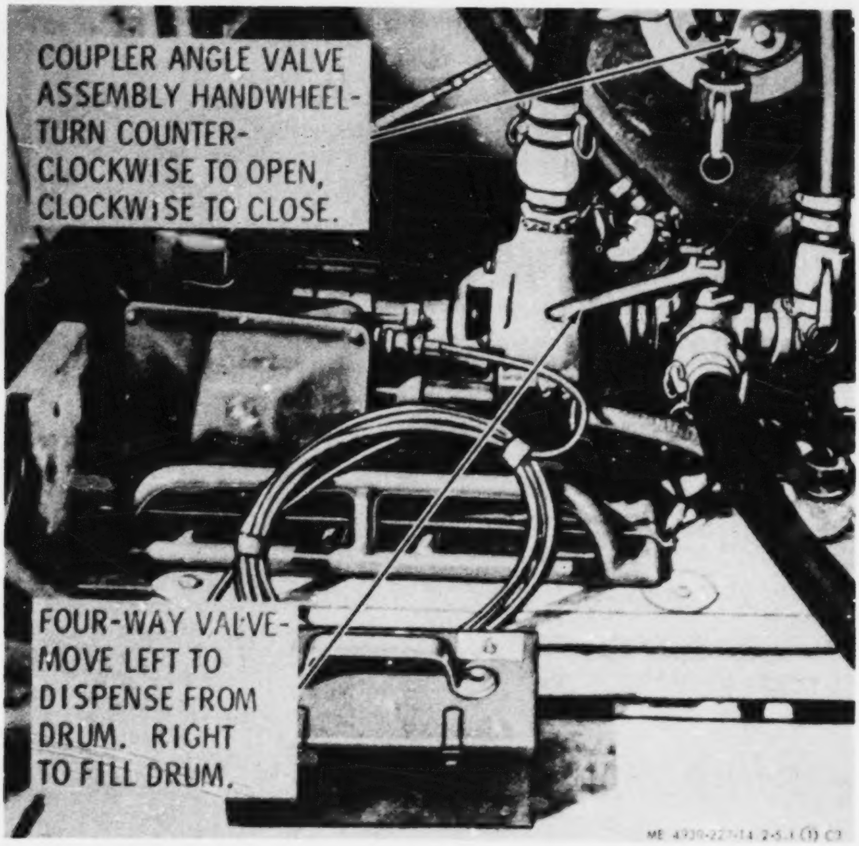
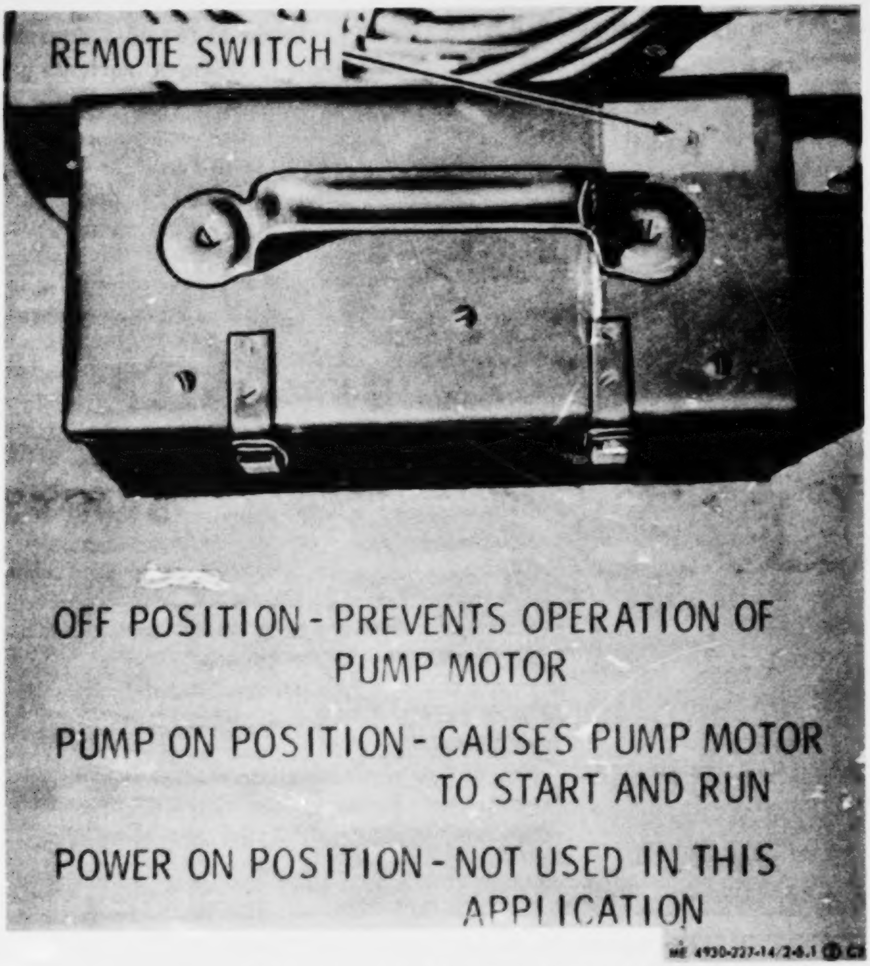

COUPLER ANGLE VALVE ASSEMBLY HANDWHEEL-TURN COUNTER-CLOCKWISE TO OPEN, CLOCKWISE TO CLOSE.
FOUR-WAY VALVE-MOVE LEFT TO DISPENSE FROM DRUM. RIGHT TO FILL DRUM.
ME 4930-227-14 2-5.1 (1) C3

Figure 2-5.1. Controls and instruments (Sheet 1 of 2)

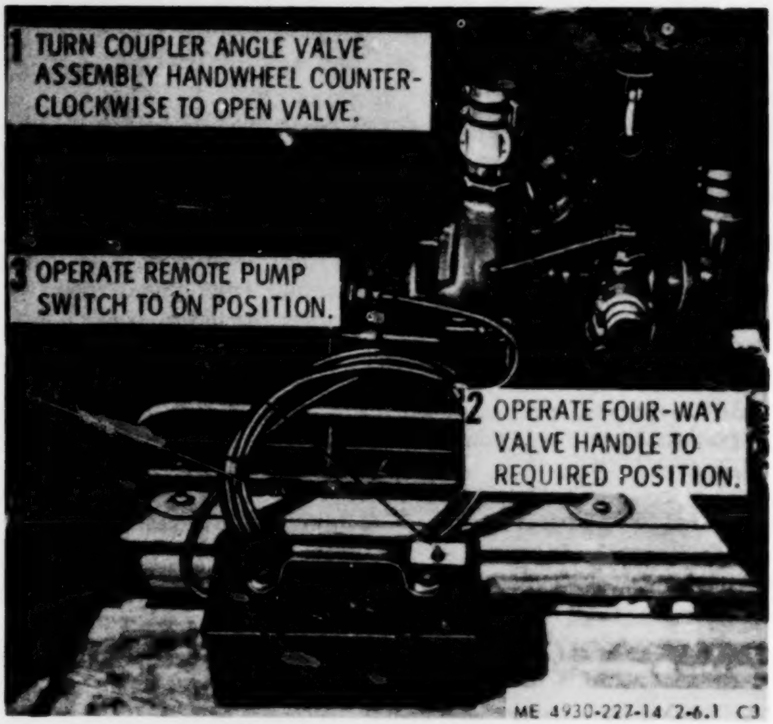

REMOTE SWITCH
OFF POSITION - PREVENTS OPERATION OF PUMP MOTOR
PUMP ON POSITION - CAUSES PUMP MOTOR TO START AND RUN
POWER ON POSITION - NOT USED IN THIS APPLICATION

ME 4930-227-14/2-5.1 ② C3

Figure 2-5.1. Controls and instruments (Sheet 2 of 2)

Page 2-12. Paragraph 2-9.*c.* is added:

c. Starting Electric Motor Driven Pump. Refer to figure 2-6.1 and start operation of the electric motor driven pump unit.



1 TURN COUPLER ANGLE VALVE ASSEMBLY HANDWHEEL COUNTERCLOCKWISE TO OPEN VALVE.

3 OPERATE REMOTE PUMP SWITCH TO ON POSITION.

2 OPERATE FOUR-WAY VALVE HANDLE TO REQUIRED POSITION.

ME 4930-227-14 2-6.1 C3

Figure 2-6.1. Starting instruction

Page 2-12. Paragraph 2-10.1 is added:

2-10.1. Stopping

To stop electric motor driven unit operate remote pump switch to off position (fig. 2-5.1)

Page 2-13. Paragraph 2-12.*d* is added:

d. The efficiency of batteries for electric motor operation decreases greatly as the temperature decreases. Operate the engine of the carrier when running the pump motor to assure full pump output in cold weather.

Page 3-7. Add the following to table 3-2:

Malfunction	*Probable cause*	*Corrective action*
15. Pump motor fails to run	*a.* Power not connected to pump motor	*a.* Connect motor to power source para 3-16.1 (12)
	b. Circuit breaker or fuse at power source open	*b.* Close circuit breaker or replace fuse
16. Motor speed too slow	*a.* Power source voltage too low	*a.* Connect unit to proper power source

Page 3-17. After paragraph 3-14 add the following:

Section VI.I. RADIO INTERFERENCE SUPPRESSION

3-14.1. General Methods Used to Attain Radio Interference Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition and high frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

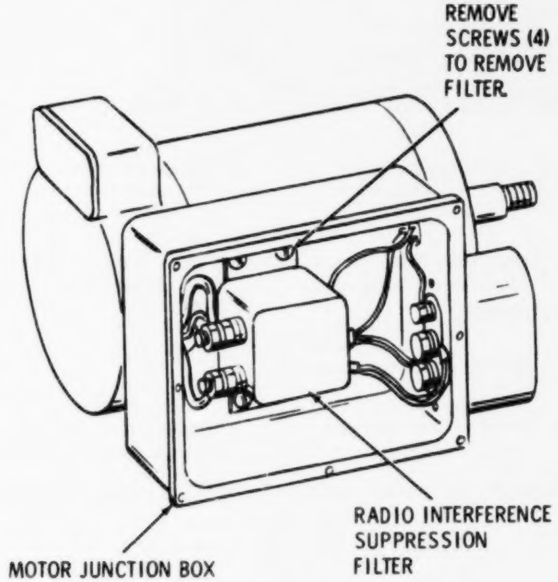
3-14.2. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference. The primary component is described and located in figure 3-3.1.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function.

3-14.3. Replacement of Suppression Components

Refer to figure 3-3.1 to replace the radio interference suppression components.


REMOVE SCREWS (4) TO REMOVE FILTER.
RADIO INTERFERENCE SUPPRESSION FILTER
MOTOR JUNCTION BOX

NOTE: TAG AND DISCONNECT ELECTRICAL LEADS.

ME 4930-227-14/3-3.1 C3

Figures 3-3.1. Interference suppression filter, location, removal and installation

3-14.4. Testing of Radio Interference Suppression Components

Test the interference filter by substitution. Replace a suspected faulty filter with one known to be good.

Page 3-7. After paragraph 3-16 add paragraph 3-16.1:

3-16.1. Conversion of Gasoline Engine-Driven Pump to Electric Motor-Driven Pump

(1) Disconnect the quick disconnect hose coupling from pump inlet. (1, fig. 3-4.1). Disconnect discharge hose (1, fig. 3-4.2).

(2) Remove muffler support bracket and muffler (2, fig. 3-4.1).

(3) Remove 2 each front bolts, (1, fig. 3-4.3) and 2 rear bolts (2, fig. 3-4.2).

(4) Remove pump and engine assembly by sliding out through front of frame assembly.

(5) Remove 90° elbow (1, fig. 3-4.2), from inlet of pump and remove tee (3, fig. 3-4.1), with cap from discharge end.

(6) Install tee (1, fig. 3-4.1) in pump discharge outlet with cap into pump.

(7) Install 90° elbow (1, fig. 3-4.5) into inlet of pump.

(8) Slide pumping assembly into frame assembly

(9) Secure the 2 front bolts (1, fig. 3-4.6).

(10) If the 2 rear bolts will not line up, use 2 3/8" X1"X1"X2" hook bolts, to secure pumping unit hose to tank and pump unit frame (2, fig. 3-4.5).

(11) Connect the inlet hose (3, fig. 3-4.5) and discharge hose (5, fig. 3-4-4), assemblies to and discharge hose (5, 3-4.4), assemblies to pump assembly.

(12) Insert the power cable plug into receptacle provided on vehicle cab.

(13) Insert power cable plug (2, fig. 3-4.4 into the motor junction box 3).

CAUTION

Make certain that the remote switch is in OFF position.

(14) Secure the remote control plug (4, fig. 3-4.4), to the motor junction box.

ge 3-7:

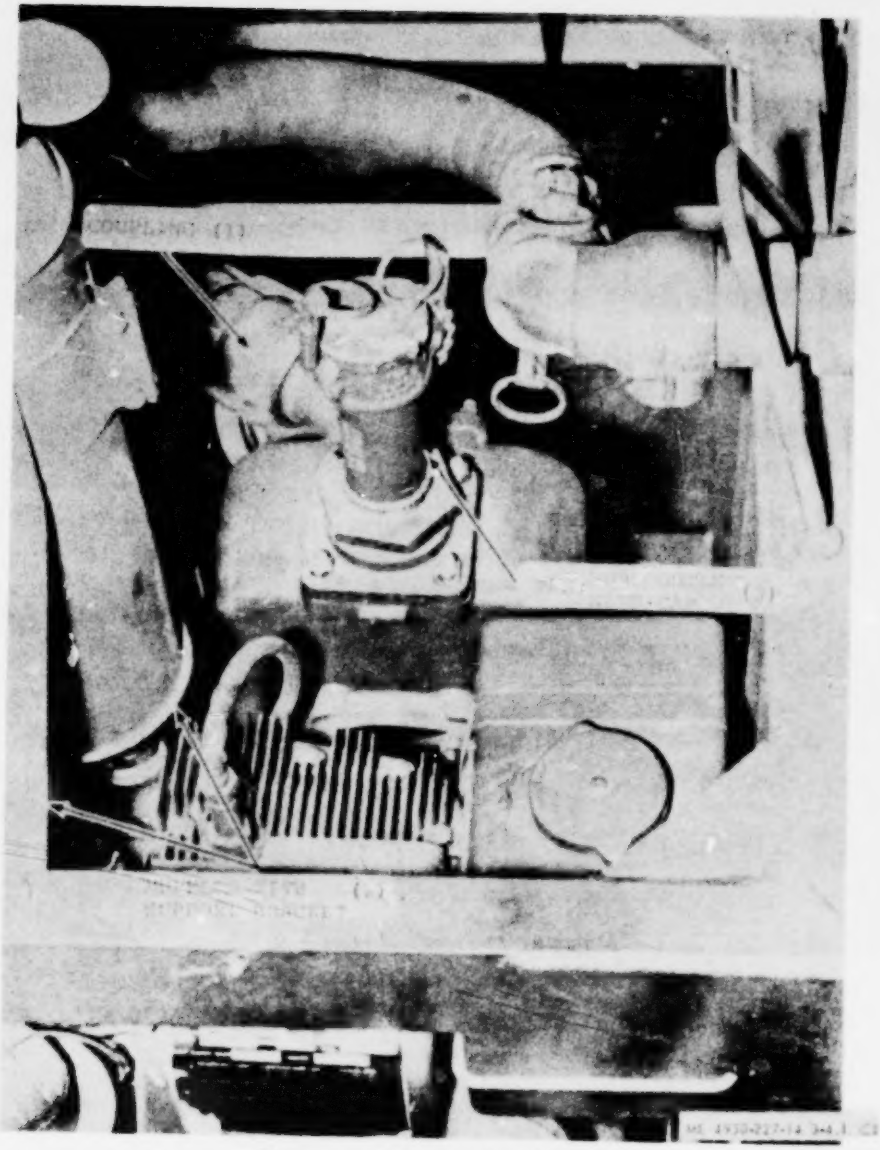

COUPLING (1)
SUPPORT BRACKET
ME 4930-227-14 3-4.1 C3

Figure 3-4.1. Pump and engine unit

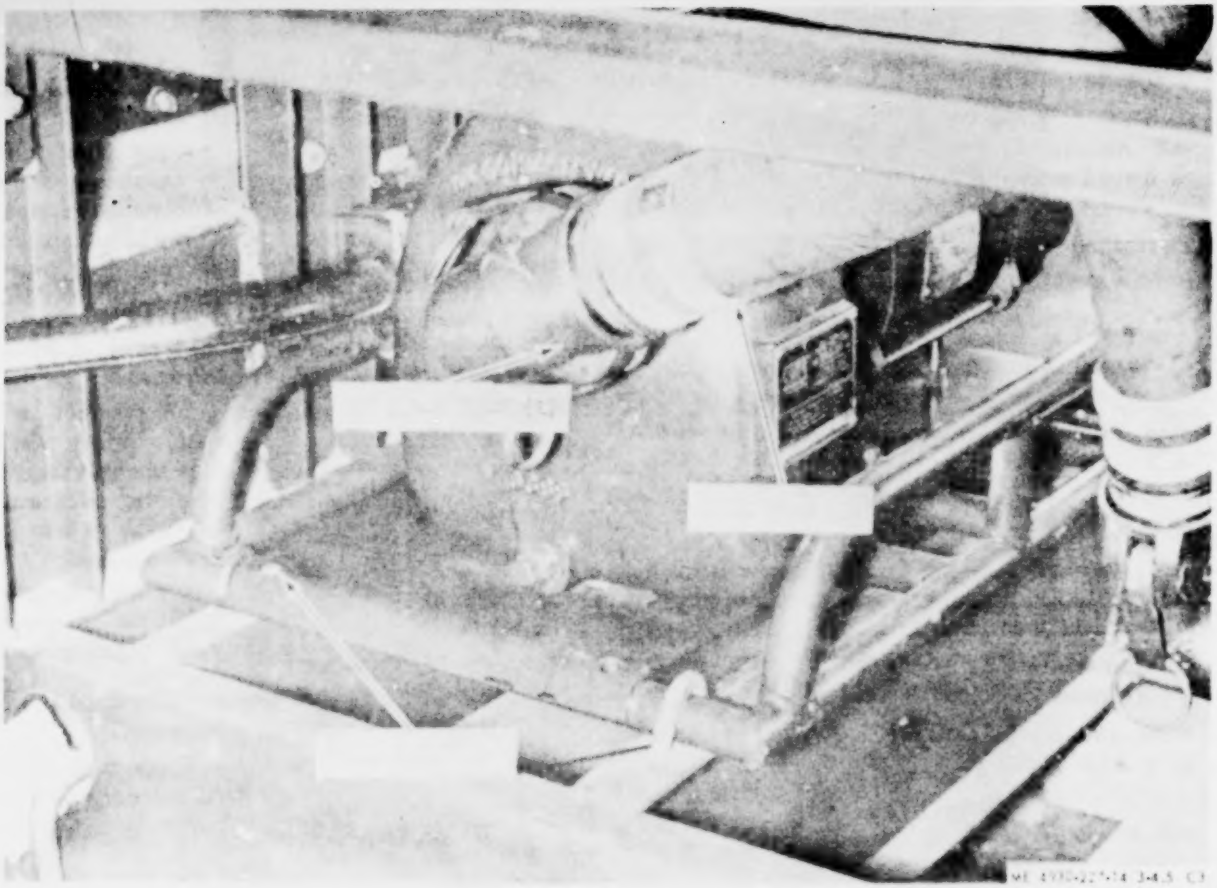

ME 4930-227-14 3-4.2 C3

Figure 3-4.2. Pump and engine unit

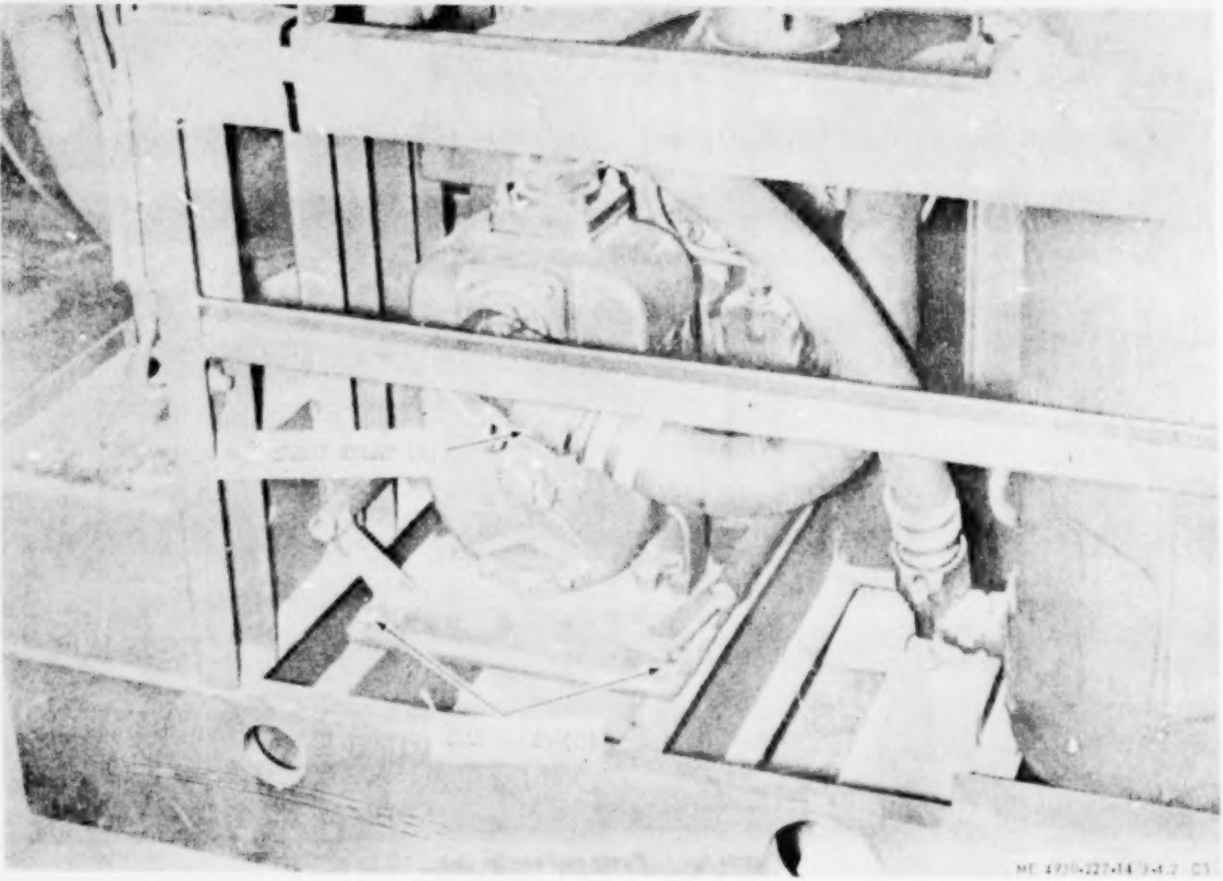

ME 4930-227-14/3-4.3 C3

Figure 3-4.3. Pump and engine unit

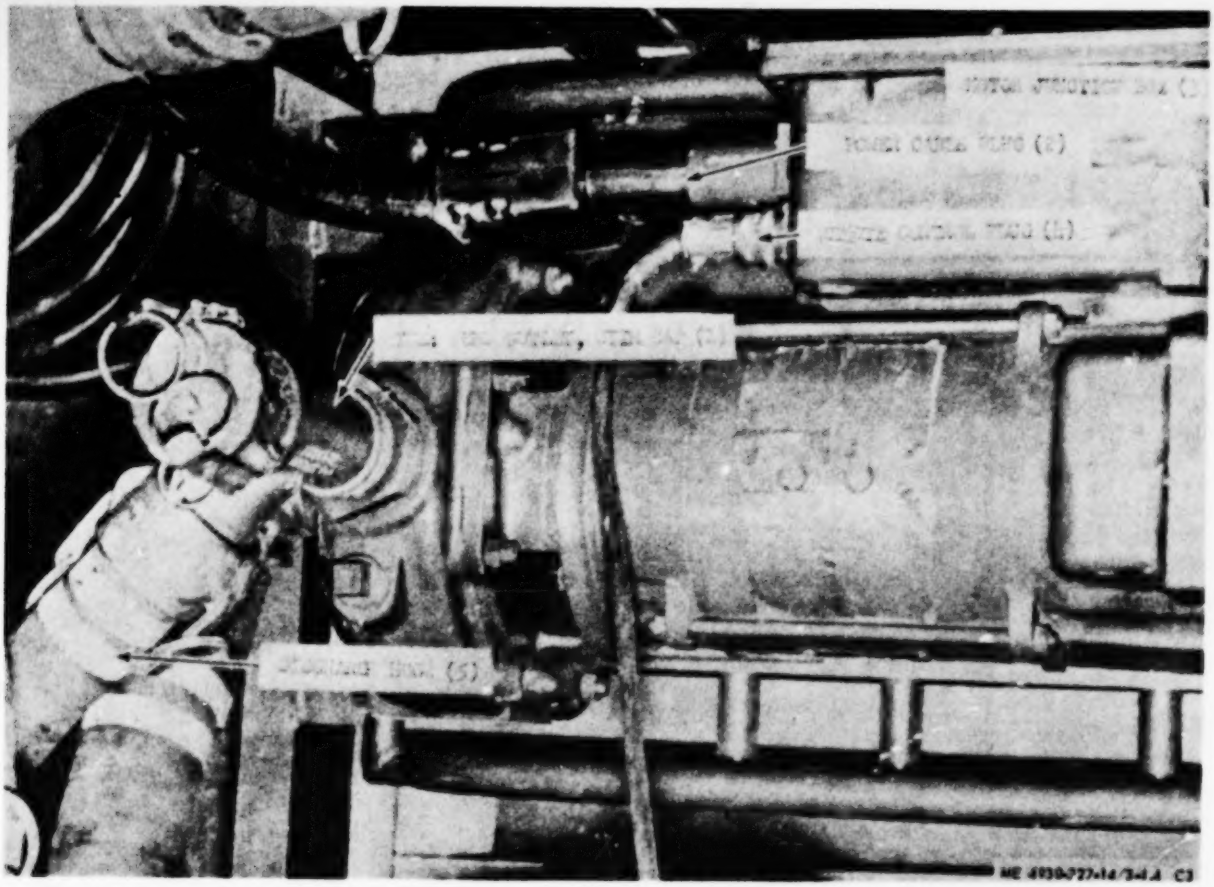

MOTOR JUNCTION BOX (1)
POWER CABLE PLUG (2)
REMOTE CONTROL PLUG (4)
DISCHARGE HOSE (5)
ME 4930-227-14/3-4.4 C3

Figure 3-4.4. Pump and engine unit

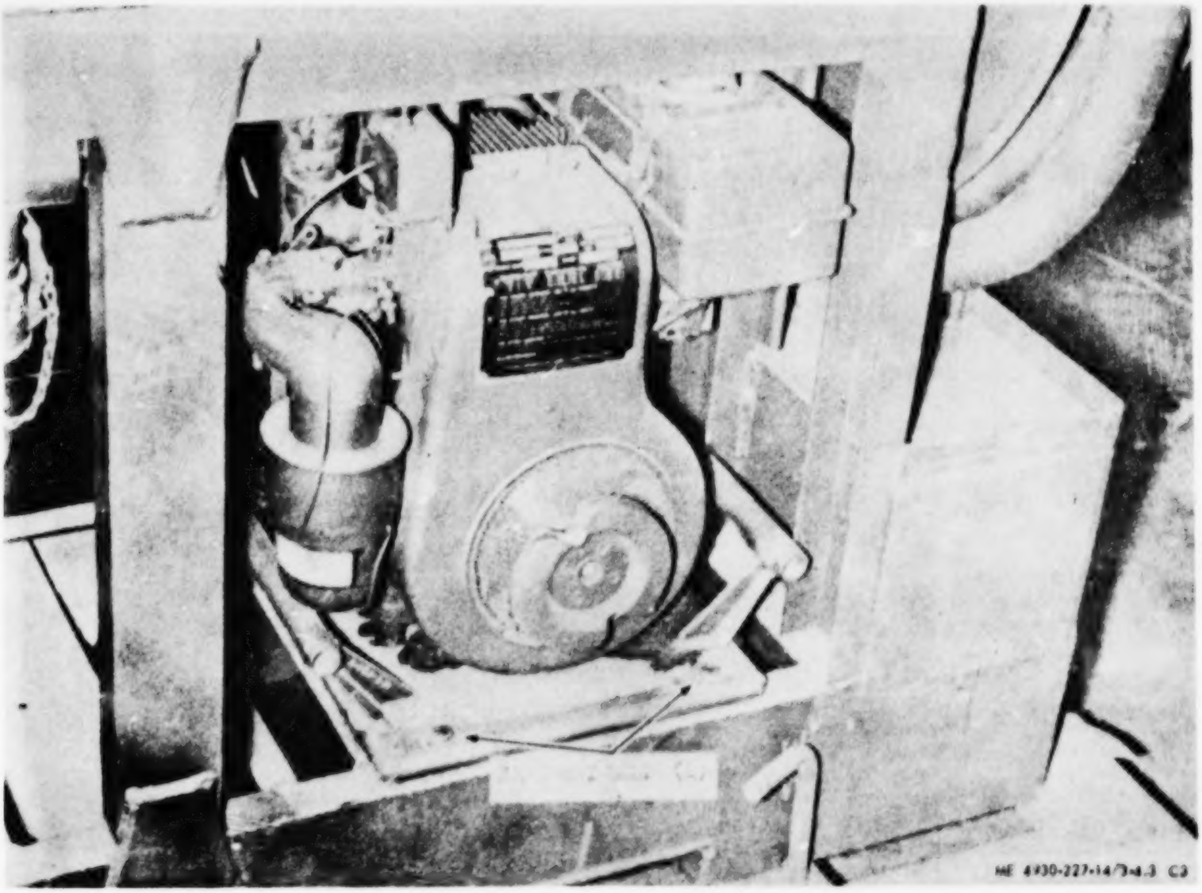

ME 4930-227-14/3-4.5 C3

Figure 3-4.5. Pump and engine unit

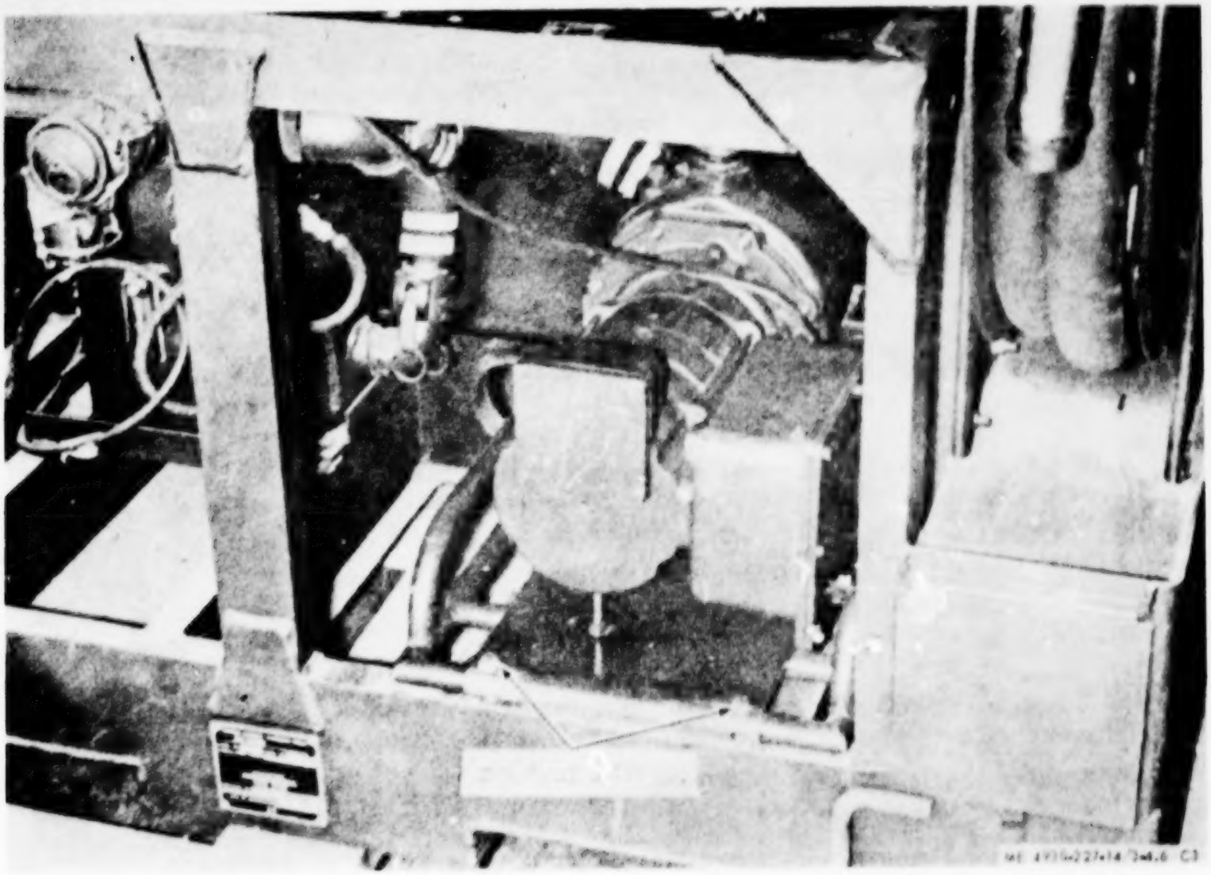


Figure 3-4.6. Pump and engine unit

Page 3-9. After paragraph 3-17*e*. add the following:

3-17.1. Electric Motor and Pump

a. Disassembly. To disassemble the pump unit proceed as follows:

(1) Disconnect hoses from pump unit and remove from carrier.

(2) Refer to figure 3-6.1, and disassemble pump and remove motor.

CAUTION

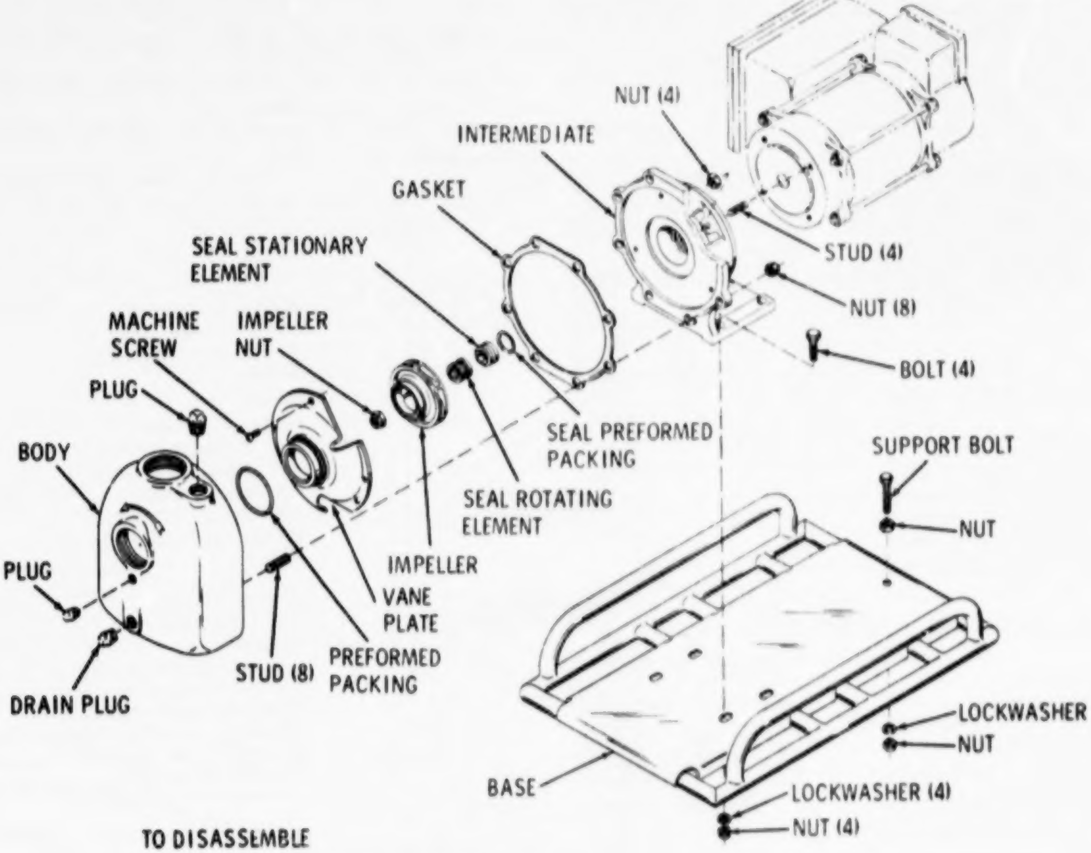
Prior to removal of seal, wipe shaft area clean of all particles.

b. Cleaning and Inspection. Clean and inspect the pump as follows:

(1) Clean all parts as required; dry thoroughly with clean compressed air.

(2) Inspect all parts for excessive wear, cracks, scoring, and other damage. Replace all gaskets and seals, and all other defective parts.

c. Reassembly. Refer to figure 3-6.1 and reassemble the pump. Figure 3-6.2 shows clearance requirements between impeller and intermediate and provides instructions for seal installation.


NUT (4)
INTERMEDIATE
GASKET
SEAL STATIONARY ELEMENT
MACHINE SCREW
IMPELLER NUT
PLUG
BODY
PLUG
DRAIN PLUG
STUD (8)
PREFORMED PACKING
VANE PLATE
IMPELLER
SEAL ROTATING ELEMENT
SEAL PREFORMED PACKING
STUD (4)
NUT (8)
BOLT (4)
SUPPORT BOLT
NUT
LOCKWASHER
NUT
BASE
LOCKWASHER (4)
NUT (4)

TO DISASSEMBLE

1. REMOVE DRAIN PLUG TO DRAIN BODY.
2. REMOVE EIGHT NUTS SECURING BODY TO INTERMEDIATE; PULL FORWARD ON BODY TO REMOVE IT. REMOVE GASKET.
3. REMOVE THREE MACHINE SCREWS SECURING VANE PLATE TO INTERMEDIATE; REMOVE VANE PLATE.
4. INSERT SCREWDRIVER IN SLOT AT END OF MOTOR SHAFT TO PREVENT ROTATION. REMOVE IMPELLER NUT AND IMPELLER FROM SHAFT.
5. SLIDE SEAL ROTATING ELEMENT FROM SHAFT.
6. REMOVE FOUR NUTS SECURING MOTOR TO INTERMEDIATE; REMOVE MOTOR.
7. REMOVE FOUR BOLTS, NUTS, AND LOCKWASHERS SECURING INTERMEDIATE TO BASE: REMOVE INTERMEDIATE.
8. REMOVE SUPPORT BOLT, TWO NUTS, AND LOCKWASHER FROM BASE.

TO REASSEMBLE

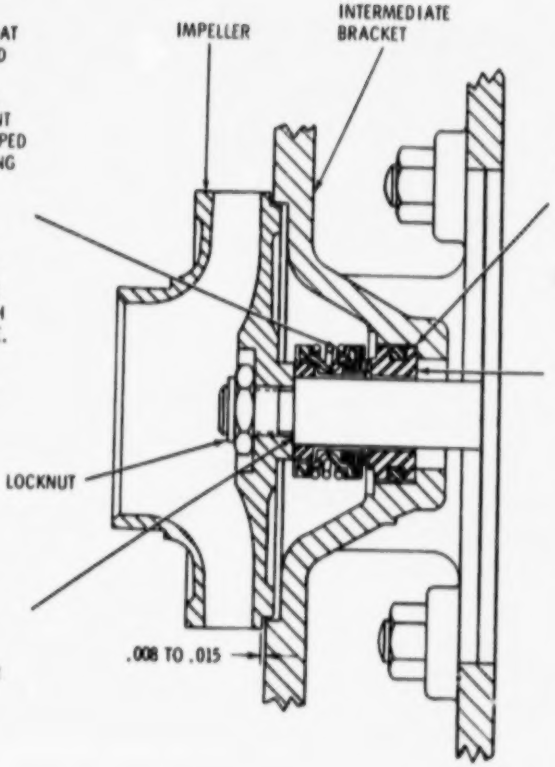
1. REVERSE DISASSEMBLY PROCEDURE TO REASSEMBLE. REFER TO FIGURE 6-2 FOR CLEARANCE INFORMATION AND SEAL REPLACEMENT INSTRUCTIONS.
2. USE EC847 SEALANT, MANUFACTURER'S CODE (94959) BETWEEN VANE PLATE AND INTERMEDIATE.
3. AFTER REASSEMBLY, ADJUST POSITION OF SUPPORT BOLT TO SUPPORT END OF MOTOR.

ME 4930-227-14/3-6.1 C3

Figure 3-6.1. Centrifugal pump, disassembly and reassembly

3. CLEAN AND APPLY LIGHT COAT OF OIL TO MOTOR SHAFT AND LAPPED SURFACE OF SEAL ROTARY ELEMENT. INSTALL ASSEMBLED ROTARY ELEMENT ON MOTOR SHAFT WITH LAPPED SURFACE OF ELEMENT FACING MOTOR.

CAUTION: PRESS ONLY ON TAIL SECTION OF DRIVING BAND. IF ROTARY ELEMENT WILL NOT SLIDE INTO PLACE WITH FINGERS, USE SMOOTH SLEEVE TO PUSH INTO PLACE. MAKE SURE NO DUST OR FOREIGN MATERIAL IS ON LAPPED SURFACES OF SEAL AS SURFACES ENGAGE.



1. APPLY LIGHT COAT OF OIL, MIL-L-2104, GRADE 10 TO BORE OF INTERMEDIATE BRACKET.

2. INSTALL STATIONARY RING AND O-RING ON MOTOR SHAFT AND INTERMEDIATE BRACKET WITH LAPPED (POLISHED) SURFACE FACING TOWARD IMPELLER.

CAUTION: TAKE CARE DURING INSTALLATION OF STATIONARY RING TO AVOID DAMAGE TO LAPPED SURFACE. STATIONARY RING MUST BOTTOM SQUARELY IN BORE. A MARRED SURFACE OR IMPROPERLY SEATED STATIONARY RING WILL RESULT IN LEAKAGE WHEN PUMP IS RESTORED TO SERVICE.

4. ADD SHIMS AS NECESSARY TO OBTAIN .008 TO .015 IN. BETWEEN BACK OF IMPELLER AND INTERMEDIATE BRACKET. CHECK CLEARANCE WITH FEELER GAGE WHEN IMPELLER IS TIGHTLY SECURED TO SHAFT.

NOTE: IF ONLY SEAL HAS BEEN REPLACED, SHIM THICKNESS WILL BE SAME AS BEFORE DISASSEMBLY.

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Figure 3-6.2. Centrifugal pump, seal and impeller installation

Page 5-2. Paragraph 5-4*e*, 5-4.*f* and 5-4*g* are added:

e. Electric Motor Classifications and Ratings.

Horsepower	1.33 hp (horsepower)
Voltage (dc)	28 volts
Amperes (at no load)	45 amps
No-load speed	4200 rpm
Rotation	Counterclockwise facing drive end
Type of encloseure	Explosion-proof
Lubrication	Sealed bearings
Thermal protector cutout temperature	250°F (120°C)

f. Motor Rewinding Information.

Armature:	
Number of slots	18
Number of commutator segments	18
Number of single coils	18
Conductor copper size	4 No. 16
Turns per coil	4
Feet of wire per coil	18
Conductor insulation	MIL-W-583 Type HPF
Insulating materials	
Slot cell (basic ground)	.010 in. E.I. DuPont "Nomex" polyamide paper
Slot cell (basic ground) (alternate)	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Shaft insulation	.010 in. E.I. DuPont "Nomex" polyamide paper
Shaft insulation (alternate)	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
End fiber laminations	1/16 in. polyester glass (NEMA G.P. GPO-1)
End fiber laminations	Glass-Melamine (MIL-P-15037 Type GME)
Slot wedge	1/16 in. polyester glass (NEMA G.P. GPO-1)
Slot wedge	Glass-Melamine (MIL-P-15037 Type GME)
Coil overlap insulation	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)

Under leads to commutator	.007 in., varnished glass cloth (MIL-I-17205)
Coil lead sleeving	Braided glass (MIL-I-13190)
Adhesive tape	.006 in. woven glass (MIL-I-15126 Type GFT)
Coil lead ties	.015 in. thk, 1/2 in. wide Dacron-glass tie tape
Commutator washer	Dacron-Mylar-Dacron D-100 3/14/3 (MIL-I-22834)
Commutator lead band	Glass cord
Dipping compounds	Varnish, Schenectady No. 31 (MIL-I-24092CL. 155 Type M)
Dipping and baking procedures	Preheat armature for two hours at 315 to 325°F. Dip in varnish and bake for one hour at 315 to 325°F. Repeat two more times, extending last baking time to 6 hours.
Stator shunt winding	
Conductor copper size	No. 23
Turns per coil	1000
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	1200
Stator series winding	
Conductor copper size	No. 14
Turns per coil	2
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	21
Stator intercoil winding	
Conductor copper size	No. 14
Turns per coil	24
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	47
Stator	
Insulating materials	
Inner periphery strip	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Between shunt and series	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Glass adhesive tape	.007 in. woven glass (MIL-I-15126)
Coil lead sleeving	Acrylic glass
Interpole flanges	Glass-Melamine (MIL-P-15037, Type GME)
Glass tape	.007 in. woven (MIL-Y-1140 Class C ECAA)
Interpole ground insulation	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Field coil insulation	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Ground insulation collar	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Lead cable	MIL-W-583 Type L-2 AWG #10 (Beldon)
Dipping compound	Varnish, Schenectady, No. 31 (MIL-I- 24092 CL 155 Type M)
Dipping and baking procedures	Preheat field winding for 2 hours at 315 to 325°F. Dip in varnish and bake for 1 hour at 315 to 325°F. Repeat two more times, extending the last baking time to 6 hours

g. Electric Motor Repair and Replacement Standards

Shunt field winding resistance	41.87 ohms
Series field winding resistance	.0063 ohms
Interpole winding resistance	.0129 ohm

Page 5–2. Add the following to Table 5–3.

Malfunction	*Probable cause*	*Corrective action*
5. Electric motor fails to run or fails to reach rated speed	*a.* Brushes worn or stuck in holders	a. Disassemble motor to check brushes. Clean and free or replace brushes as necessary (para 6–8.1)
	b. Commutator burned, pitted, or dirty	*b.* Disassemble motor; clean or turn down commutator. Replace rotor if commutator is worn or damaged beyond repair (para 6–8.1)
	c. Armature shorted or open	c. Repair or replace armature (para 6–8.1)
	d. Stator shorted or open	*d.* Repair or replace stator winding (para 6–8.1)
	e. Thermal unit open	e. Replace thermal unit buried in stator winding (para 6–8.1)
	f. Power relay coil open	*f.* Replace power relay (para 6–8.1)
6. Electric motor noisy or vibrates excessively	*a.* Motor bearings worn, dry, or damaged	*a.* Overhaul motor (para 6–8.1)
	b. Armature laminations rubbing against pole pieces	*b.* Overhaul motor and correct trouble (para 6–8.1)
7. Electric motor overheats	*a.* Bearings dry or damaged.	*a.* Overhaul motor (para 6–8.1)
	b. Armature or stator shorted	*b.* Replace or repair armature or stator (para 6–8.1)
8. Electric motor runs for short while then stops	Thermal overload protector imbedded in stator defective	Replace thermal overload protector (para 6–8.1)

Page 6–4. Paragraph 6–8.1 is added:

6–8.1. Electric Motor

a. Removal and Disassembly. To remove and disassemble the pump drive motor, proceed as follows:

(1) Remove the pump as shown in figure 3–6.1.

(2) Refer to figure 6–11.1 and disassemble the motor. The sequence of disassembly is indicated by the index numbers assigned.

(3) Do not remove the stator coils (58) unless inspection indicates that they are open, shorted, grounded, or have low insulation resistance.

b. Cleaning and Inspection. To clean and inspect the unit, proceed as follows:

(1) Clean all metallic parts as required; dry thoroughly.

(2) Clean the exterior of electrical parts as required. Take care to prevent saturation of electrical winding, leads, and contacts.

(3) Inspect the armature shaft (55) for worn or damaged bearing seats, bent shaft extension, windings broken away from the commutator risers, and worn or burned commutator.

(4) Use test equipment listed in table 6–1 to perform electrical tests of motor components.

CAUTION

> Remove electrical leads from item 31, figure 6–11.1 prior to removal of rear head, item 35.

Table 6–1. Test Equipment

Item	*FSN or part no*	*Use*
Multimeter	6625–242–5023	Check continuity of circuits and resistance of stator
Megger	6625–246–5880 Model ZM–2A/U	Check dielectric strength of winding insulation.

(5) Check the armature for shorts with a growler. Use a multimeter to check for grounds by checking for continuity between the armature shaft and each commutator bar. No continuity should exist. Check for open armature windings with a multimeter. Continuity should exist between all adjacent commutator bars.

(6) Inspect brushes (38) for cracks, chips, oil saturation, and wear. If brushes are damaged or worn to less than ½ inch long, replace them.

(7) Inspect the brush ring (41) for cracks, distortion, bent or loose brushholder studs. Inspect the brush boxes on the brush ring for distortion and wear. Replace a damaged brush ring.

(8) Inspect the stator assembly for cracks, distortion, and damaged winding insulation. Check the stator coils (58) for continuity by using a multimeter. Continuity must exist across the coils. Check field resistance with a multimeter. Resistance values are given in Maintenance Data, paragraphs 5–4*e*. Check for grounds with a multimeter. No continuity should exist between the winding terminals and an unpainted portion of the stator frame (59). With radio frequence interference suppression filter (23) disconnected, apply 1500 volts for one second between ground and stator leads to check insulation resistance. Repair or replace a damaged stator.

CAUTION

> Failure to disconnect radio frequency interference suppression filter before applying high insulation resistance test voltage will burn out the filters.

(9) Inspect the power relay (31) for binding armature movement and for burned or worn contact points. If points are dirty, insert a piece of card stock between the points and manually operate the armature. Pull out the card stock to burnish the points. Repeat as necessary. Apply 24 volts *dc* to the operating coil of the relay and check relay operation. Points should close instantly and firmly when the coil is energized and should release immediately when the coil is deenergized.

(10) Check the interference filter (23) for cracks and dents. Check for continuity across each of the three circuits of the filter using a multimeter. Continuity must exist across each circuit. Replace a faulty filter, part number JN–14828A.

(11) Inspect electrical connector (11) and the plug assembly (14) for cracks, damaged threads, loose or broken terminals, damaged insulation and other damage; replace damaged parts.

(12) Inspect the front head (44), rear head (35), conduit box (26), and cover (2) for cracks, distortion, worn or damaged threads, and other damage; replace damaged parts.

(13) Inspect all other parts for cracks, distortion, damaged threads, and other damage; replace damaged parts.

c. Repair. To repair the unit, proceed as follows:

(1) If armature shaft windings are damaged, rewind the armature as follows:

(*a*) Refer to the motor rewinding information in the tabulated data, paragraph 5-4*e*.

(*b*) Stack laminations on the shaft with 3/32 inch glass-polyester mat lamination end fibers in place. Place slot cells (fig. 6-11.2) in the core to insulate the shaft. Use glass adhesive tape to hold shaft insulation in place.

(*c*) Use a piece of 2/2/2 dacron-mylardacron per MIL-I-22834 to insulate the overlap coils on the end turns.

(*d*) Separate commutator leads with a layer of 0.007 inch (minimum) varnished glass cloth per MIL-I-17205.

(*e*) Hold coils in place with wedges of polyester-glass mat per NEMA G.P. GPO-1.

(*f*) Dip and bake the armature as indicated in paragraph 5-4*e*.

(2) Repair a slightly burned or pitted commutator with OO sandpaper. If the commutator is badly scored pitted or burned, turn down the commutator on a lathe. Take light cuts and remove only enough metal to assure that the commutator is clean and smooth. Finish the commutator with OO sandpaper held against the commutator with a block of wood. After finishing, undercut the mica separators to a depth of 1/32 inch, using a hacksaw blade 0.035 inch wide. Smooth commutator with OO sandpaper after undercutting.

(3) If stator windings are shorted, burned, or grounded, rewind the stator as follows:

(*a*) Refer to motor rewinding information in tabulated data, paragraph 5-4*e*.

(*b*) Wind the field coils on forms with the inner periphery strip placed around the form before winding. Refer to figure 6-11.3.

(*c*) Wind the shunt winding first, then position the insulation around the shunt winding before winding the series windings around the shunt windings.

(*d*) Weld leads to coil ends. Insulate welds with acrylic sleeving. Insulate pole connection coil leads with acrylic sleeving.

(*e*) Tape coils overall 1/2 inch with glass tape, lapped one-half its width every turn. Tape leads securely to the coils. Insert the taped coils and ground insulation into the field structure before impregnation with varnish per MIL-I-24092, CL 155, Type M.

(*f*) When unwinding the interpole coil, carefully note the position of the thermal overload protector imbedded within the windings to assure that it will be replaced in the same position from which it was removed.

(*g*) When winding the interpole coils, place the ground insulation around the interpole iron before winding. Also install the top and bottom flanges before winding. While winding, carefully imbed the thermal overload protection in the coils in the same position from which it was removed, (subpara (*f*) above).

(*h*) Insulate the interpole leads with acrylic sleeving.

(*i*) Assemble the interpole coils into the field structure before varnish impregnation.

(*j*) Dip and bake the field windings as indicated in para. 5-4*e*.

d. Reassemble and Installation. To reassemble and install proceed as follows:

(1) Reassembly is essentially the reverse of diassembly. Refer to figure 6-11.1.

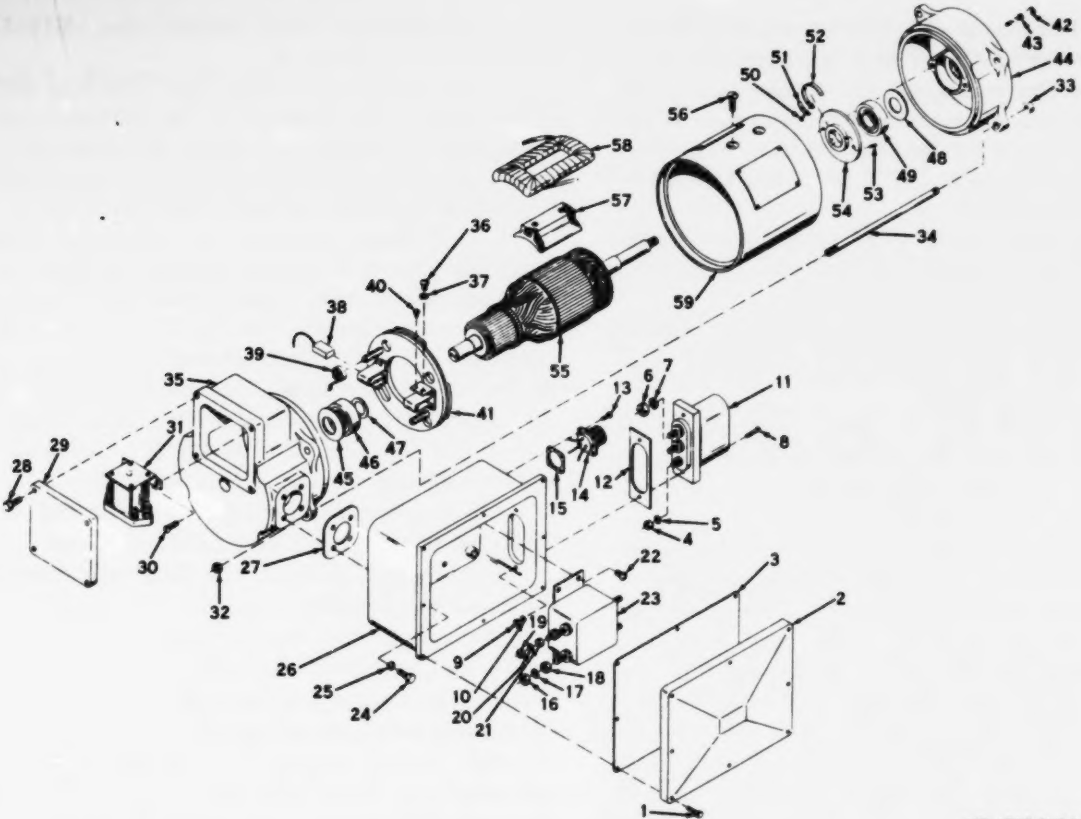
(2) When pressing the bearings (46 and 49) onto the armature shaft (55), use a sleeve that will fit over the end of the shaft and will engage the inner race of the bearing. The end of the sleeve must be square with the length to assure that equal force is applied to all parts of the inner race. Use an arbor press to install the bearings.

(3) When installing the stator coils (58), use a pole-shoe spreader to assure that pole shoes are properly seated in the stator frame.

(4) After pulling the wires from the relay (31) through the head-to-conduit port in the rear head, the port must be sealed around the wires. Sealing is done with wicking and sealing compound (70020) Bi-Wax 510, to the dimensions shown in figure 6-11.4.

(5) After reassembly, rotate the armature shaft through several rotations to assure that it rides freely in the bearings and that it does not rub or bind.

(6) Install the pump on the motor (para 3-17.1)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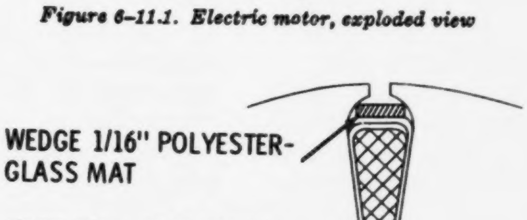
1	Screw, machine (8 rqr)
2	Conduit box cover
3	Gasket
4	Nut
5	Washer, lock
6	Nut (2 rqr)
7	Washer, lock (2 rqr)
8	Screw flat head (2 rqr)
9	Nut (2 rqr)
10	Washer, lock (2 rqr)
11	Connector, electrical
12	Gasket
13	Screw, fillister head
14	Plug assembly
15	Gasket
16	Nut (4 rqr)
17	Washer, lock (4 rqr)
18	Nut (4 rqr)
19	Nut (2 rqr)
20	Washer, lock (2 rqr)
21	Nut (2 rqr)
22	Screw, machine (4 rqr)
23	Interference filter
24	Screw, cap (4 rqr)
25	Washer, lock (4 rqr)
26	Conduit box
27	Gasket
28	Screw, cap (4 rqr)
29	Inspection cover
30	Screw, machine (2 rqr)
31	Power relay
32	Nut (4 rqr)
33	Nut (4 rqr)
34	Thru stud (4 rqr)
35	Rear head
36	Machine screw (2 rqr)
37	Washer, lock (2 rqr)
38	Brush (4 rqr)
39	Brush spring (4 rqr)
40	Screw, machine (2 rqr)
41	Brush ring
42	Pipe plug (2 rqr)
43	Screw, machine (2 rqr)
44	Front head
45	Thrust spring
46	Ball bearing
47	Bearing back plate
48	Shim
49	Ball bearing
50	Screw, machine (2 rqr)
51	Spring clip
52	Spring
53	Carbon brush
54	Bearing clamp and grounding ring
55	Armature shaft
56	Screw, flat head (4 rqr)
57	Pole shoe (2 rqr)
58	Stator coil
59	Stator frame

Figure 6–11.1. Electric motor, exploded view


WEDGE 1/16" POLYESTER-GLASS MAT
SLOT CELL .010" (MIN.) "NOMEX" PAPER OR 3/5/3 DMD-100

ME 4930-227-14/6-11.2 C3

Figure 6–11.2. Armature slot detail

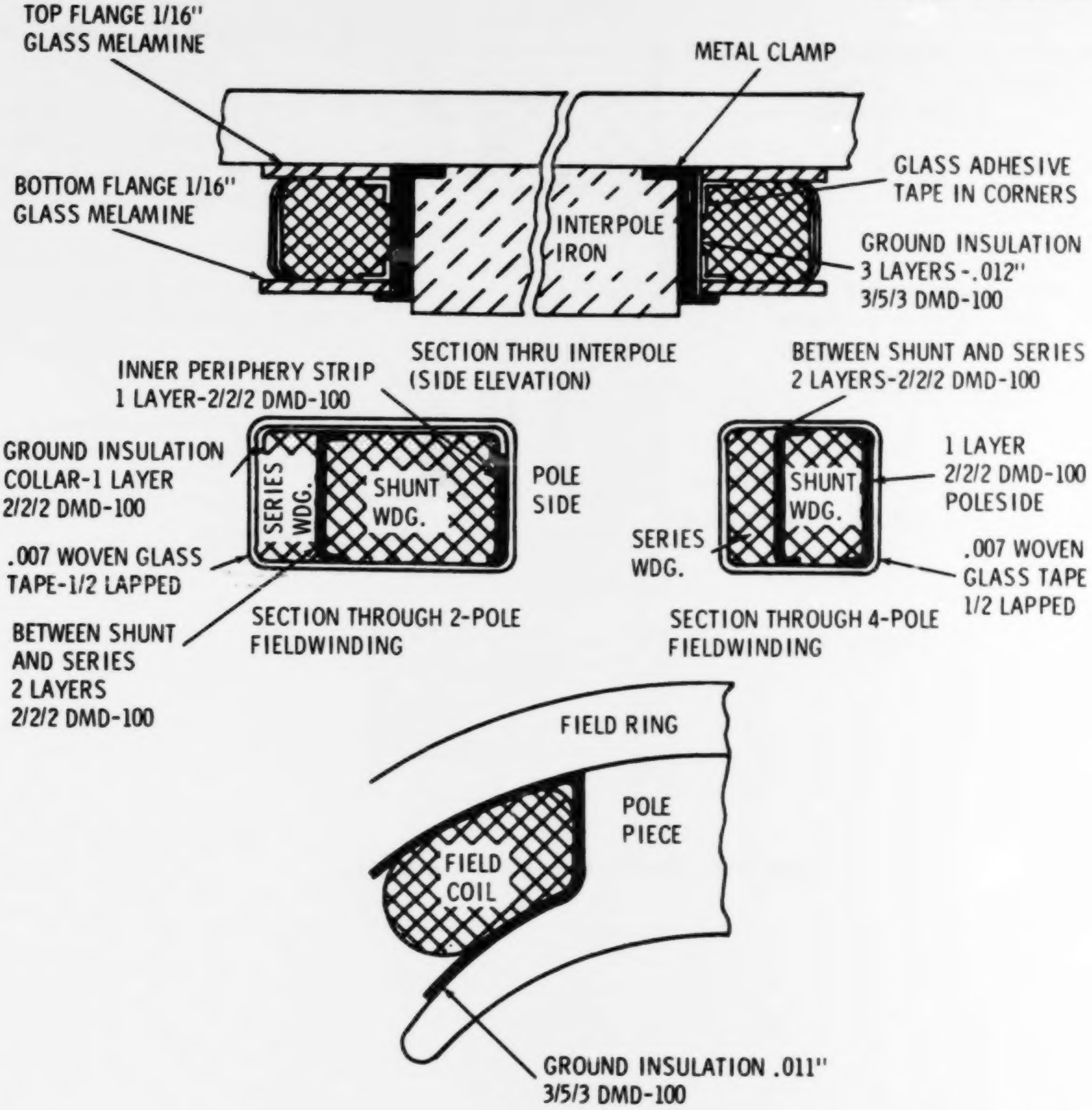

TOP FLANGE 1/16"
GLASS MELAMINE
METAL CLAMP
BOTTOM FLANGE 1/16"
GLASS MELAMINE
GLASS ADHESIVE
TAPE IN CORNERS
INTERPOLE
IRON
GROUND INSULATION
3 LAYERS -.012"
3/5/3 DMD-100
SECTION THRU INTERPOLE
(SIDE ELEVATION)
INNER PERIPHERY STRIP
1 LAYER-2/2/2 DMD-100
BETWEEN SHUNT AND SERIES
2 LAYERS-2/2/2 DMD-100
GROUND INSULATION
COLLAR-1 LAYER
2/2/2 DMD-100
SERIES
WDG.
SHUNT
WDG.
POLE
SIDE
.007 WOVEN GLASS
TAPE-1/2 LAPPED
BETWEEN SHUNT
AND SERIES
2 LAYERS
2/2/2 DMD-100
SECTION THROUGH 2-POLE
FIELDWINDING
SHUNT
WDG.
1 LAYER
2/2/2 DMD-100
POLESIDE
SERIES
WDG.
.007 WOVEN
GLASS TAPE
1/2 LAPPED
SECTION THROUGH 4-POLE
FIELDWINDING
FIELD RING
POLE
PIECE
FIELD
COIL
GROUND INSULATION .011"
3/5/3 DMD-100

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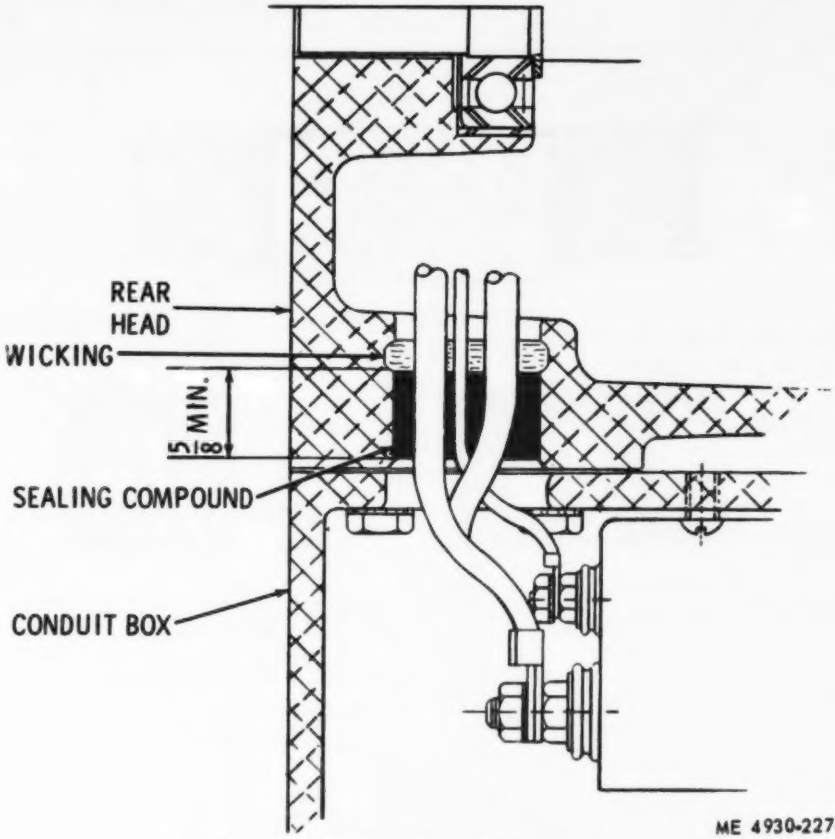
Figure 6–11.3. Stator winding detail


REAR HEAD
WICKING
5/8 MIN.
SEALING COMPOUND
CONDUIT BOX

ME 4930-227-14/6-11.4

Figure 6-11.4. Sealing dimensions for rear head port

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS,
General, United States Army,
Chief of Staff.

Official:
VERNE L. BOWERS
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block No. 154), Organizational maintenance requirements for Petroleum Distribution.

C3

Changes in force: C 1 and C 2

TM 5-4930-227-14
C2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *30 April 1973*

Operator, Organizational, Direct and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (HIGHLAND INDUSTRIES MODEL 2000) FSN 4930-877-8678

TM 5-4930-227-14, 13 June 1969, is changed as follows:

Page 2-12. Following paragraph 2-8 add:

CAUTION

It is mandatory that the performance of filter/separator on all aircraft refueling equipment be checked every 30 days through the submission of samples taken from the effluent stream of the filter/separator.

Page C-1. Appendix C is superseded as follows:

APPENDIX C
BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section 1. INTRODUCTION

C-1. Scope.

This appendix lists items required by the operator for operation of the tank and pump unit.

C-2. General

This list is divided into the following sections:

a. Basic Issue Items List — Section II. Not applicable

b. Items Troop Installed or Authorized List — Section III. A list of items of alphabetical sequence, which at the discretion of the unit commander may accompany the tank and pump unit. These items are NOT SUBJECT TO TURN-IN with the tank and pump unit when evacuated.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. Source, Maintenance and Recoverability Code (SMR). Not applicable.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A two character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Furnished with Equipment (BILL). Not applicable.

f. Quantity Authorized (Items Troop Installed or Authorized). This column indicates the quantity of the item authorized to be used with the equipment

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal Stock Number	(3) Description Ref No. & Mfr Code / Usable on code	(4) Unit of meas	(5) Qty auth
	7520-559-9618	CASE, Maintenance and Operation Manuals	EA	1

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A, (qty rqr block no. 154) Organizational maintenance requirements for Petroleum Distribution.

TECHNICAL MANUAL
No. 5-4930-227-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *13 June 1969*

Operator, Organizational, Direct
Support, and General Support
Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING, FOR TRUCK MOUNTING
(HIGHLAND INDUSTRIES MODEL 2000)
FSN 4930-877-8678

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3-21 Muffler, disassembly and reassembly
3-22 Filter/separator, removal and installation
3-23 Filter/separator, disassembly and reassembly
3-24 Hoses, nozzles and bonding wires, removal and installation
3-25 Hose reels and spring housing assembly, removal and installation
3-26 Hose rollers, removal and installation
3-27 Hose reels, disassembly and reassembly
3-28 Ground reel and clips, removal and installation
3-29 Ground reel, disassembly and reassembly
3-30 Nozzle assembly, disassembly and reassembly
3-31 Manifold, removal and installation
3-32 Tank assembly service
3-33 Manhole cover, removal and installation
3-34 Drain valve assembly, disassembly and reassembly
3-35 Discharge valve assembly, disassembly and reassembly
6-1 Cylinder head, removal and installation
6-2 Cylinder head bolts, tightening sequence
6-3 Tappet cover plate, removal, installation, and clearance measurement
6-4 Valves, removal, disassembly, reassembly and installation
6-5 Engine base and oil pump, removal and installation
6-6 Engine base and oil pump, disassembly and reassembly
6-7 Piston and connecting rod, removal and installation
6-8 Piston and connecting rod, disassembly and reassembly
6-9 Crankshaft, removal and installation
6-10 Crankshaft, disassembly and reassembly
6-11 Camshaft and governor, removal, disassembly, reassembly, and installation

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1–1. Scope

a. These instructions are published for the use of the personnel maintaining the Tank and Pump Unit, Model 2000, as allocated by the Maintenance Allocation Chart. It provides information on operator, organizational, direct support, and general support maintenance of the equipment, its accessories, and auxiliaries. The organizational, direct and general support maintenance repair parts and special tool list are in TM 5–4930–227–24P.

b. Numbers in parentheses on illustrations indicate the quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1–2. Forms and Records

a. DA forms and records used for equipment maintenance will be only those prescribed in TM 38–750.

b. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to the Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME–MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

1–3. Administrative Storage

Refer to TM 740–90–1, administrative storage of equipment.

Section II. DESCRIPTION AND DATA

1–4. Description

a. General. The Tank and Pump Unit, Model 2000, consists of a 50 gpm (gallons per minute) pumping assembly (fig. 1–1), two 600-gallon tanks (FSN 5430–585–2529) and related items. It is designed for use with 2 1/2 ton, 6X6 cargo truck M–34, M–35 and M–211, and with 5 ton, 6X6 cargo trucks M–41 and M–54. When installed in a cargo truck, the tank and pump unit is used in the field as a bulk carrier and dispenser. It carries 1,200 gallons. The purpose of the tank and pump unit is to convert a general purpose military cargo vehicle into a bulk refueler for other military vehicles or aircraft.

b. Pumping Assembly. The pumping assembly of the Tank and Pump Unit, Model 2000, includes the pump, engine, filter/separator, reels and other related items of equipment (fig. 1–2 and 1–3).

c. Pump. The pump (fig. 1–4) is a self-priming unit, with the impeller screwed on the extension of the engine crankshaft. The pump is coupled to the engine by an intermediate coupling and seal. Both pump and engine are mounted on a base plate to facilitate removal and use in auxiliary pumping operations (para 2–11*d*).

d. Engine. The engine (fig. 1–2) is a one-cylinder, 4-cycle, air-cooled, hand-cranked, Wisconsin Gasoline Engine, Model MBKND. A radio-shielded magneto supplies the ignition spark, and a governor controls the engine speeds by varying throttle openings to suit pump loads. A gasoline tank of one gallon capacity is provided.

e. Filter/Separator. The filter/separator (fig. 1–3) is a vertical, 50 gpm unit designed for maximum operating pressure of 40 psi (pounds per square inch). Both solids and water (free from entrained water) are removed from the fuel through coalescing and filtering media of the elements inside the filter/separator. The filter/separator has four canisters and filter elements, two pressure gages, sight glass, and two drains. Solid contaminants are deposited in the elements. The emulsified or entrained water coalesces within the elements and settles to the deck plate where it is removed, periodically, through the upper drain, as free water. Clean product builds up in the shell, and is pumped to the hose reels. Refer to figure 1–5 for the flow of the pumped product.

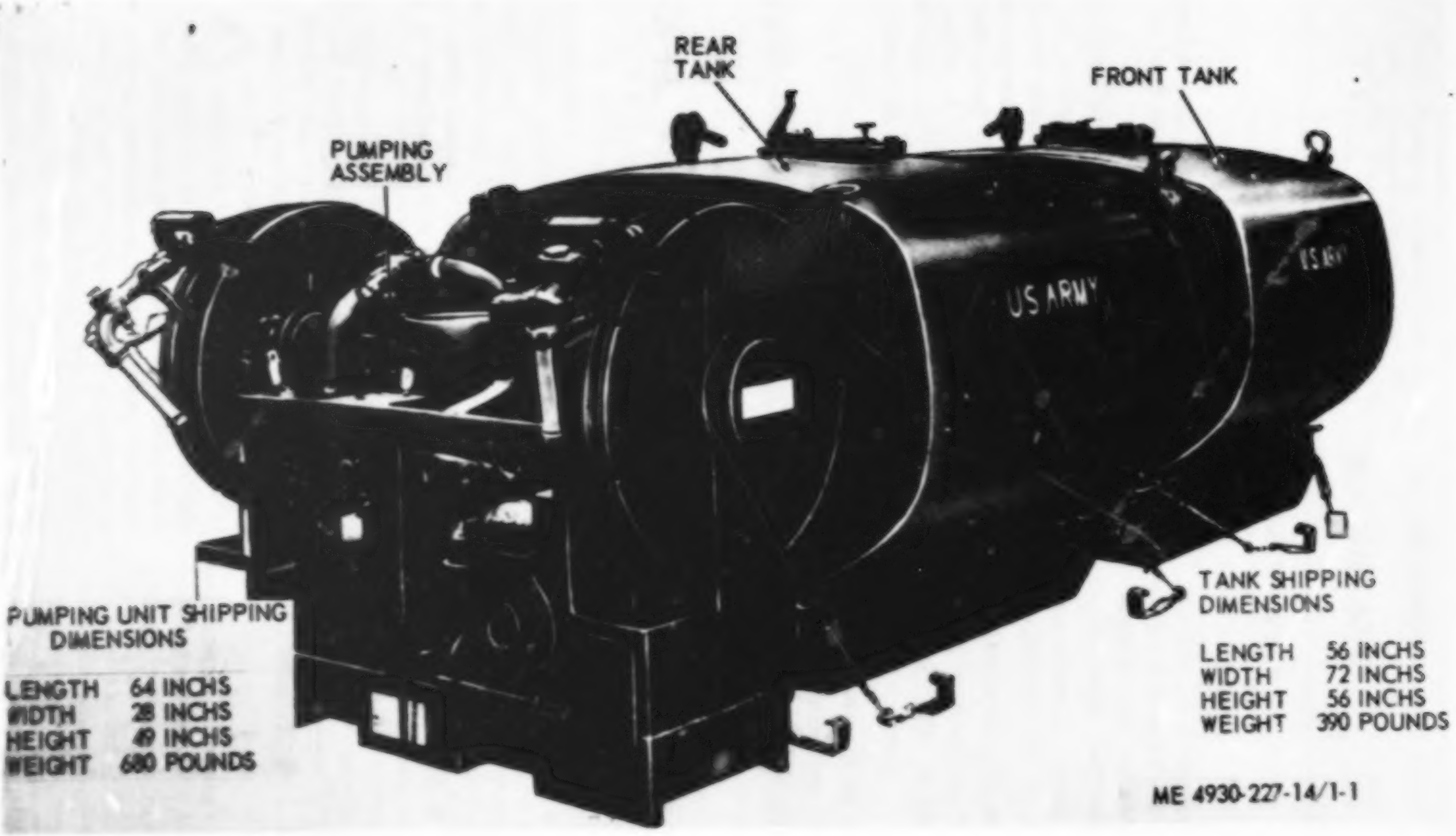
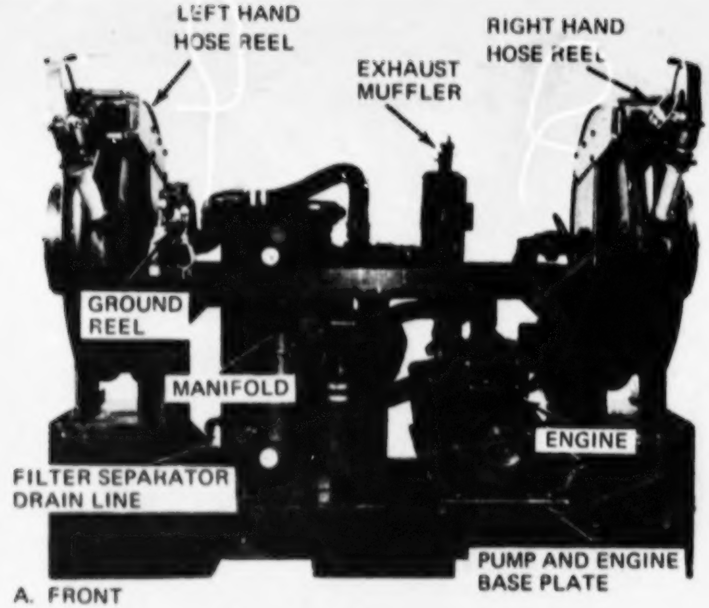
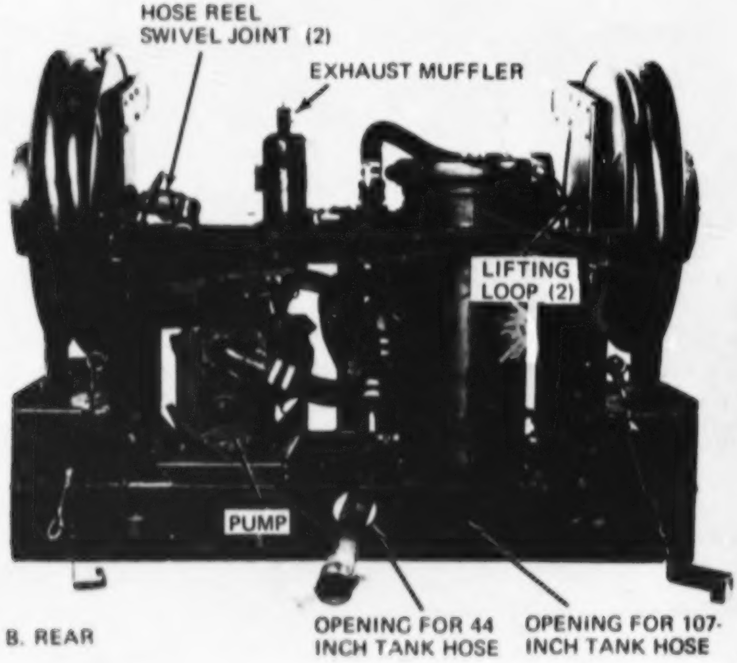

REAR TANK
FRONT TANK
PUMPING ASSEMBLY
PUMPING UNIT SHIPPING DIMENSIONS
LENGTH 64 INCHS
WIDTH 28 INCHS
HEIGHT 49 INCHS
WEIGHT 680 POUNDS
TANK SHIPPING DIMENSIONS
LENGTH 56 INCHS
WIDTH 72 INCHS
HEIGHT 56 INCHS
WEIGHT 390 POUNDS
ME 4930-227-14/1-1

Figure 1-1. Tank and pump unit, with shipping dimensions.


LEFT HAND HOSE REEL
RIGHT HAND HOSE REEL
EXHAUST MUFFLER
GROUND REEL
MANIFOLD
ENGINE
FILTER SEPARATOR DRAIN LINE
PUMP AND ENGINE BASE PLATE

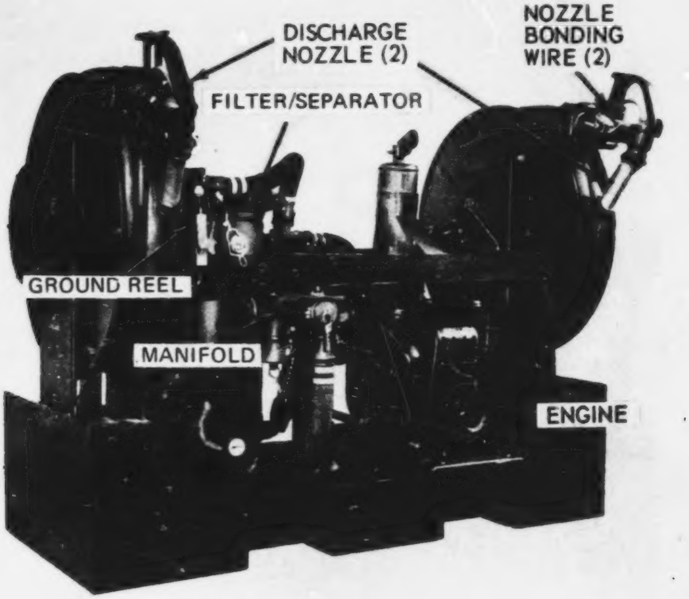
A. FRONT


HOSE REEL SWIVEL JOINT (2)
EXHAUST MUFFLER
LIFTING LOOP (2)
PUMP
OPENING FOR 44 INCH TANK HOSE
OPENING FOR 107-INCH TANK HOSE

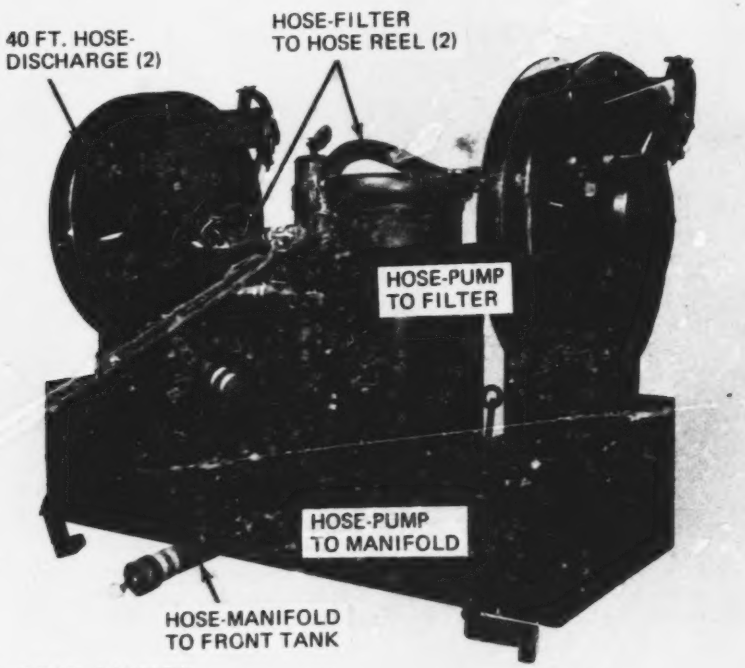
B. REAR

ME 4930-227-14/1-2

Figure 1–2. Pumping assembly, front and rear view.


DISCHARGE NOZZLE (2)
NOZZLE BONDING WIRE (2)
FILTER/SEPARATOR
GROUND REEL
MANIFOLD
ENGINE

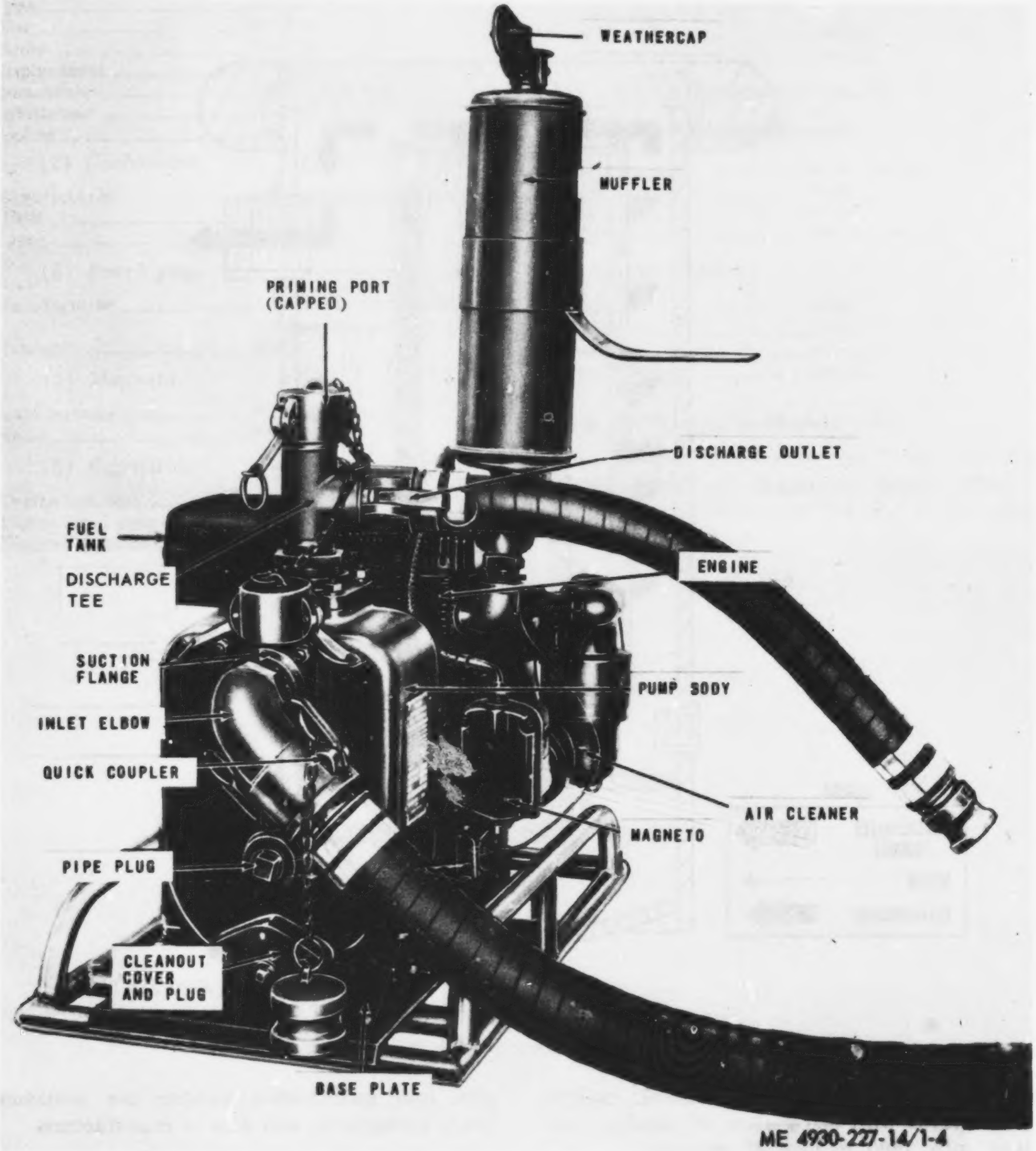
A. FRONT, 3/4 VIEW


40 FT. HOSE-DISCHARGE (2)
HOSE-FILTER TO HOSE REEL (2)
HOSE-PUMP TO FILTER
HOSE-PUMP TO MANIFOLD
HOSE-MANIFOLD TO FRONT TANK

B. REAR, 3/4 VIEW

ME 4930-227-14/1-3

Figure 1-3. Pumping assembly, front and rear, three-quarter view.


WEATHERCAP
MUFFLER
PRIMING PORT (CAPPED)
DISCHARGE OUTLET
FUEL TANK
DISCHARGE TEE
ENGINE
SUCTION FLANGE
PUMP BODY
INLET ELBOW
QUICK COUPLER
AIR CLEANER
MAGNETO
PIPE PLUG
CLEANOUT COVER AND PLUG
BASE PLATE

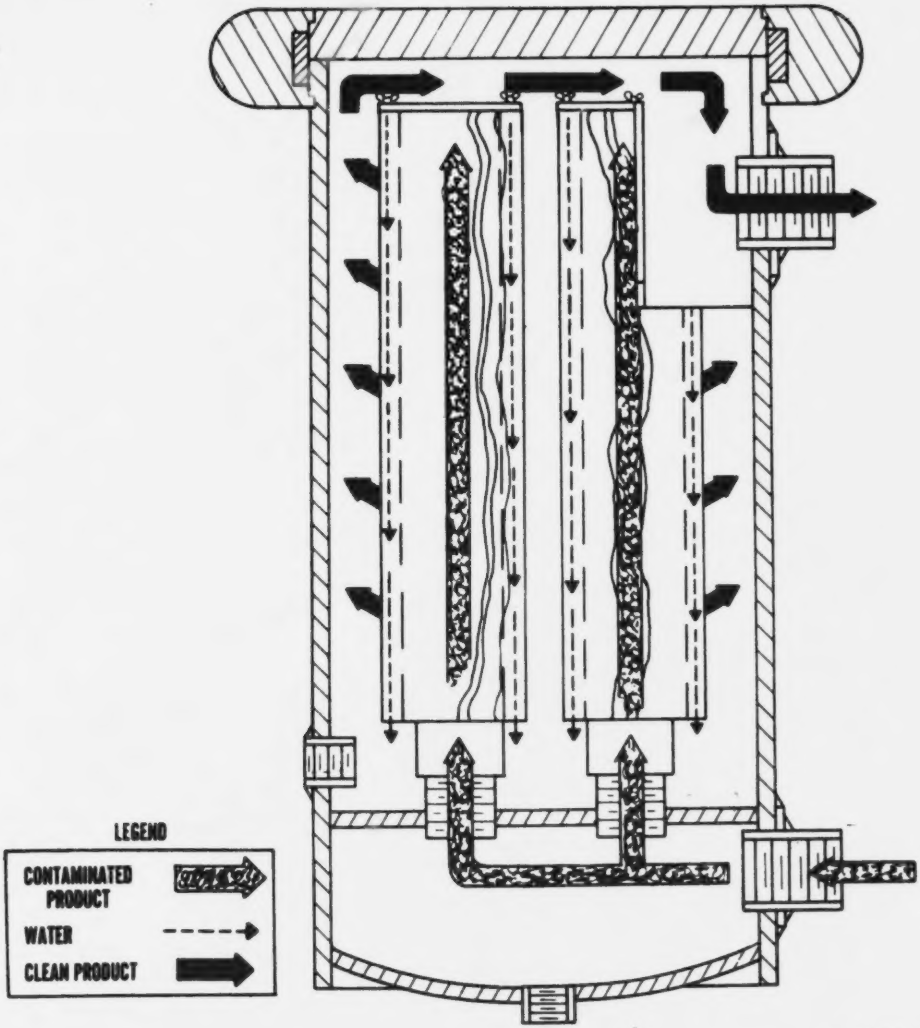
ME 4930-227-14/1-4

Figure 1-4. Pump and engine assembly, three-quarter view.

1-5. Identification and Tabulated Data

a. Identification. The tank and pump unit pumping assembly has four major identification and instruction plates.

(1) *Tank and pump unit manufacturer's plate.* Located on the lower center front frame. Specifies the nomenclature, manufacturer, model number, serial number, specification number,



ME 4930-227-14/1-5

Figure 1-5. Filter/separator flow chart.

contract number, date manufactured, weight empty, weight with 500 gallons of gasoline, and weight with 1200 gallons of gasoline.

(2) *Pump manufacturer's identification plate.* Located on the left side of pump housing. Specifies the make, model number, serial number, size, and pumping assembly Federal stock number.

(3) *Engine manufacturer's identification plate.* Located on the top front of the engine air shroud. Specifies the model, serial number, size, rpm, specification number net continuous brake horsepower, and date of manufacture.

(4) *Tank and pump unit operation data.* Located on lower left frame, specifies pre-operation procedures, engine starting and stopping instructions, and pumping instructions.

b. Tabulated Data.

(1) *Engine.*

Manufacturer	Wisconsin Motors Corp.
Model	MBKND 182918

RPM	3000
Spec. No.	18L918
Net Cont bhp	4.49
Type	4 cycle
Bore	2 7/8 in.
Stroke	2 3/4 in.
Displacement	17.8 cu in.
Horsepower	4.49 @ 3000 rpm
Lubrication	Splash
Cooling	Air

(2) *Carburetor.*

Manufacturer	Zenith Carburetor Company
Model	11193-A
Type	Float feed

(3) *Spark plug.*

Manufacturer	Auto-lite Division, Ford Motor Co.
Number	BR8S

(4) *Magneto.*

Manufacturer	Fairbanks Morse
Model	FMPE1B7

(5) *Capacities.*

Engine fuel tank	1 gal
Engine air cleaner	1/8 qt
Engine crankcase	1 qt

(6) *Adjustment data.*

Spark plug gap	0.030 in.
Magneto point gap	0.015 in.
Tappet clearance:	
Intake valve	0.008 in.
Exhaust valve	0.014 in.

(7) *Dimensions and weight.*

(*a*) *Pumping assembly.*

Length	64 in. (inches)
Width	28 in.
Height	49 in.
Weight	680 lb (pounds)

(*b*) *Tank.*

Length	56 in.
Width	72 in.
Height	56 in.
Weight (empty)	390 lbs

1-6. Difference in Models

This manual covers only the Tank and Pump Unit, Highland Industries Model 2000. No known differences exist for the model covered in this manual.

CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. Inspection and Servicing Equipment

a. Inspection.

(1) Inspect the identification plates for positive identification of the equipment.

(2) Make a thorough inspection of the pumping assembly and tanks for damage which may have occurred during shipment.

(3) Check the equipment against the packing list to make certain all items are accounted for and in serviceable condition.

(4) Inspect the components for loose or missing mounting hardware and loose connections.

(1) Turn the engine with the starter rope to make sure all moving parts are free.

b. Servicing.

(1) Lubricate the engine in accordance with lubrication order LO 5-4930-227-12.

(2) Perform preventive maintenance checks and services (para 3-7).

(3) Correct all deficiencies or report them to direct support maintenance.

2-2. Installation of Separately Packed Components

The tanks and pumping unit are shipped on individual skids. Refer to paragraph 2-3 for installation of these components.

2-3. Installation or Setting-Up Instructions

a. General. The tank and pump unit is designed for mounting in trucks. Three types of blocking frames have been devised to prevent shifting of the tank and pump unit during movement, particularly on rough terrain. Section 1 (fig. 2-1) is used in the 5 ton, 6x6 cargo truck M-54, and prevents longitudinal movement. Sections 2 and 3 are also used in the M-54 cargo truck, and in the 2 1/2 ton, 6x6 cargo trucks M-35 and M-211. They are designed to prevent side movements of the tank and pump unit. Construct frames in empty truck bed for ease in measuring lengths of lumber and assembling frames. Install tank and pump unit between the frames when the frames are constructed. Complete installation instructions are given in *b*, below. Dimensions shown in figure 2-1 must be altered slightly to take care of individual differences in dimensions of equipment. Before constructing blocking frames, check measurements of the truck bed and tank skids to determine centerline for mounting of tanks. The tanks must be centered so that section 2 blocking frames will fit properly. Also determine centerline of pumping assembly so that section 3 blocking frames will fit properly. As an alternate method, tank and pump unit may be temporarily centered in truck bed and an outline made along sides of tank skids and pumping assembly to check on dimensions used in constructing blocking frames.

b. Installation.

(1) Lower tailgate of truck and remove tarpaulin, bows, and racks with seats. Install sectional blocking frame support in M-54 cargo truck by lifting spare tire assembly and sliding the blocking frame to a position against the rear end of the truck body. Let spare tire rest against rear crosspiece.

(2) Install the two parts of section 2 against section 1, or on 2 1/2 ton cargo trucks, against rear end of truck body.

(3) Refer to figure 2-2 and install the tanks and pumping assembly in truck. Add the two parts of section 3 along sides of pumping assembly and against section 2 of blocking frame.

(4) Secure tanks and pumping assembly to sides of truck bed with horizontal tiedown assemblies. Handtight only.

c. Tank Vertical Tiedown.

(1) Refer to figure 2-3 for identification of tiedown strap assemblies.

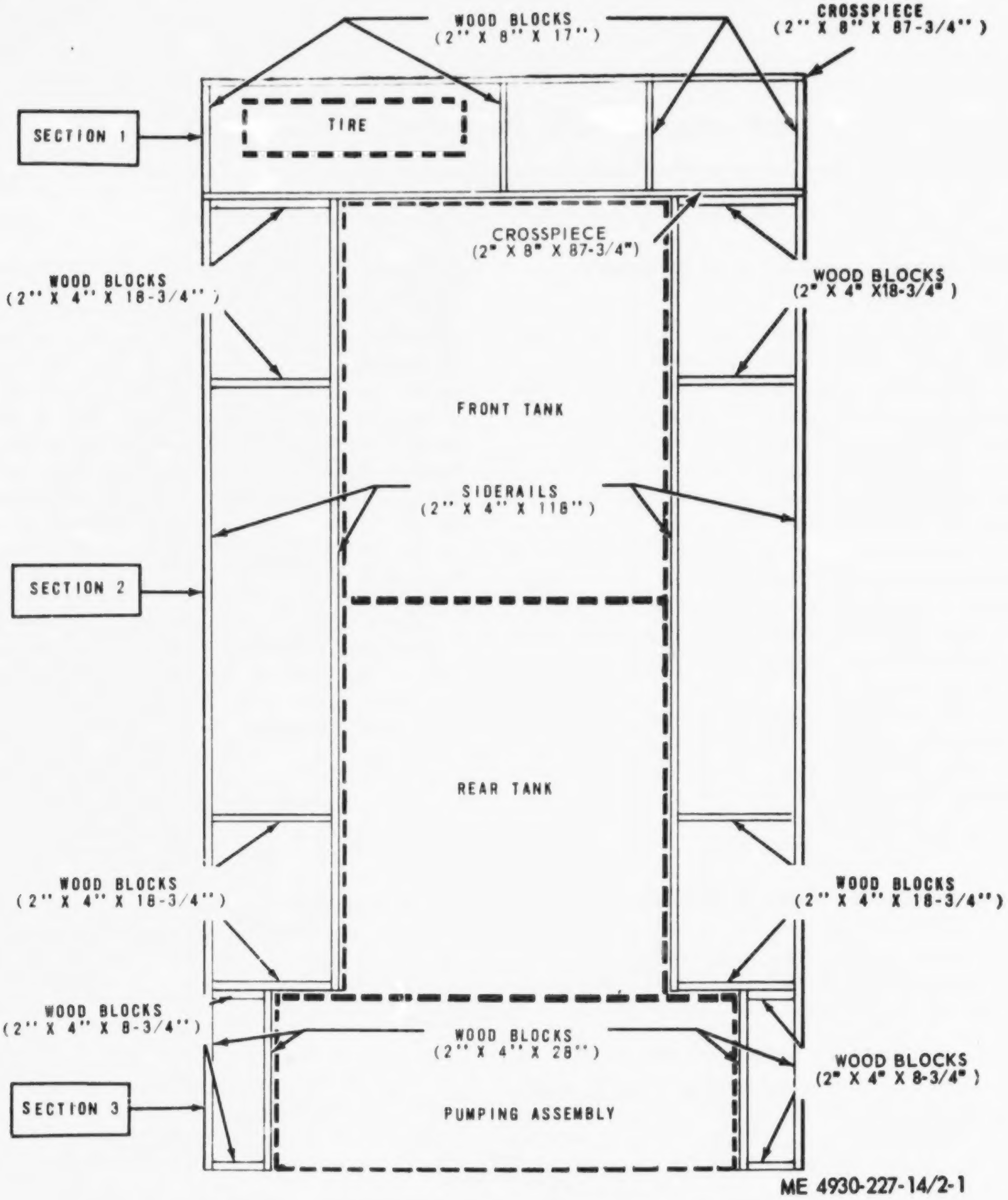
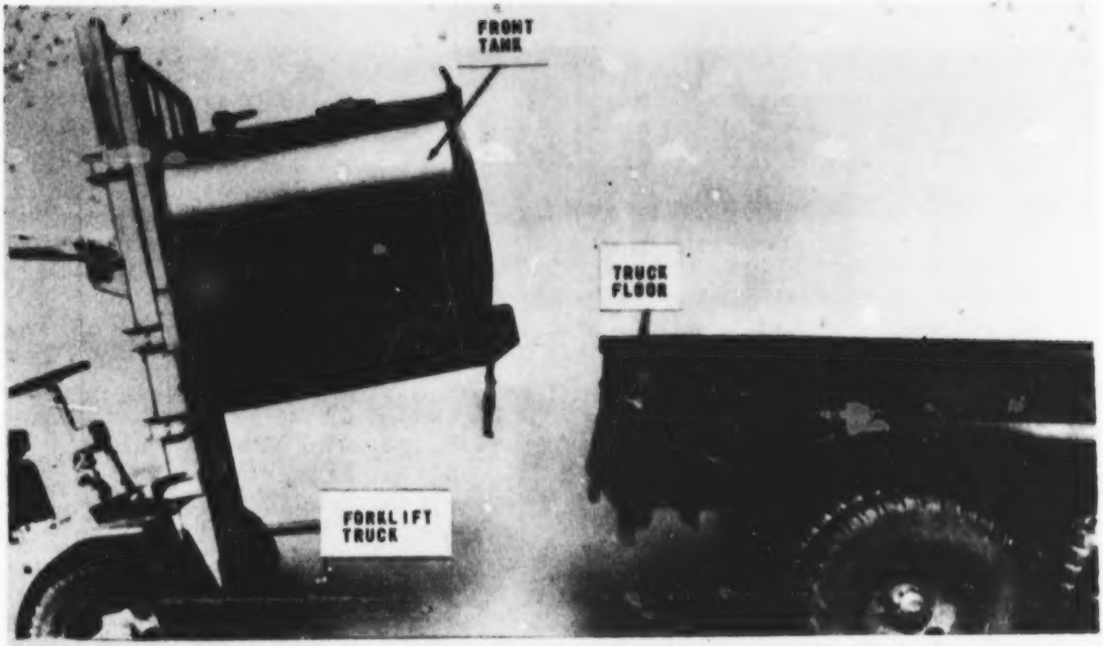
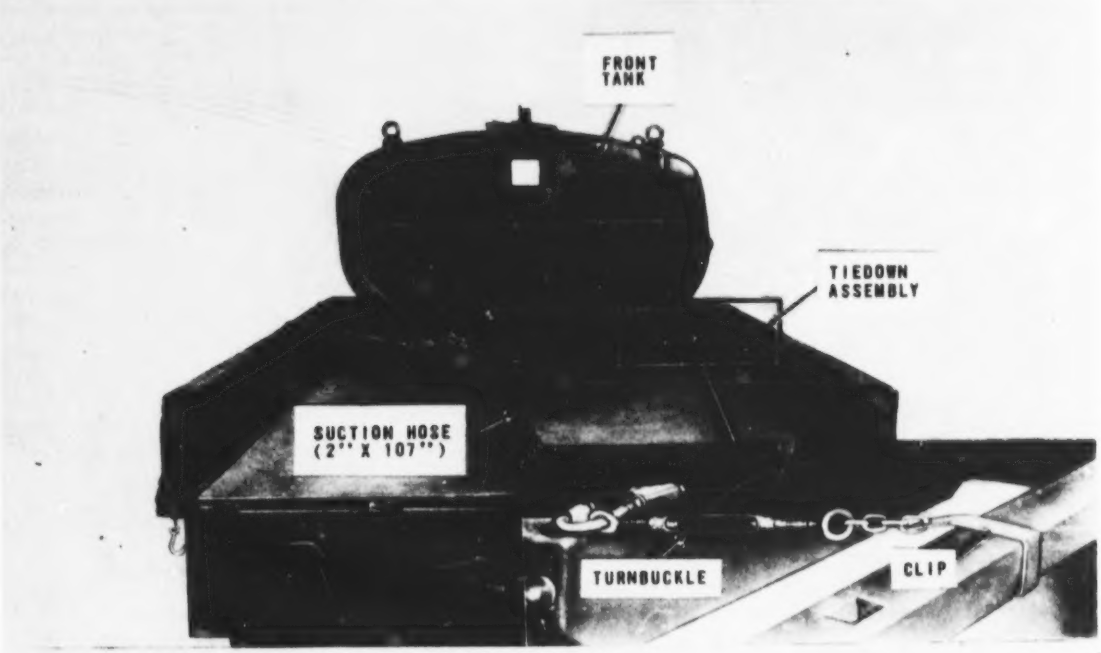

WOOD BLOCKS (2" X 8" X 17")
CROSSPIECE (2" X 8" X 87-3/4")
SECTION 1
TIRE
CROSSPIECE (2" X 8" X 87-3/4")
WOOD BLOCKS (2" X 4" X 18-3/4")
WOOD BLOCKS (2" X 4" X18-3/4")
FRONT TANK
SIDERAILS (2" X 4" X 118")
SECTION 2
REAR TANK
WOOD BLOCKS (2" X 4" X 18-3/4")
WOOD BLOCKS (2" X 4" X 18-3/4")
WOOD BLOCKS (2" X 4" X 8-3/4")
WOOD BLOCKS (2" X 4" X 28")
WOOD BLOCKS (2" X 4" X 8-3/4")
SECTION 3
PUMPING ASSEMBLY
ME 4930-227-14/2-1

Figure 2-1. Blocking instructions.

(2) To unlock or release ratchet, press release in ratchet handle. Hold release, pull handle down until side cams engage and push static ratchet locks up from ratchet dogs. This allows center ratchet spool to rotate in either direction.


FRONT TANK
TRUCK FLOOR
FORKLIFT TRUCK

STEP 1. PLACE THE FRONT TANK IN THE TRUCK WITH A FORKLIFT OR OTHER SUITABLE LIFTING DEVICE.


FRONT TANK
TIEDOWN ASSEMBLY
SUCTION HOSE (2" X 107")
TURNBUCKLE
CLIP

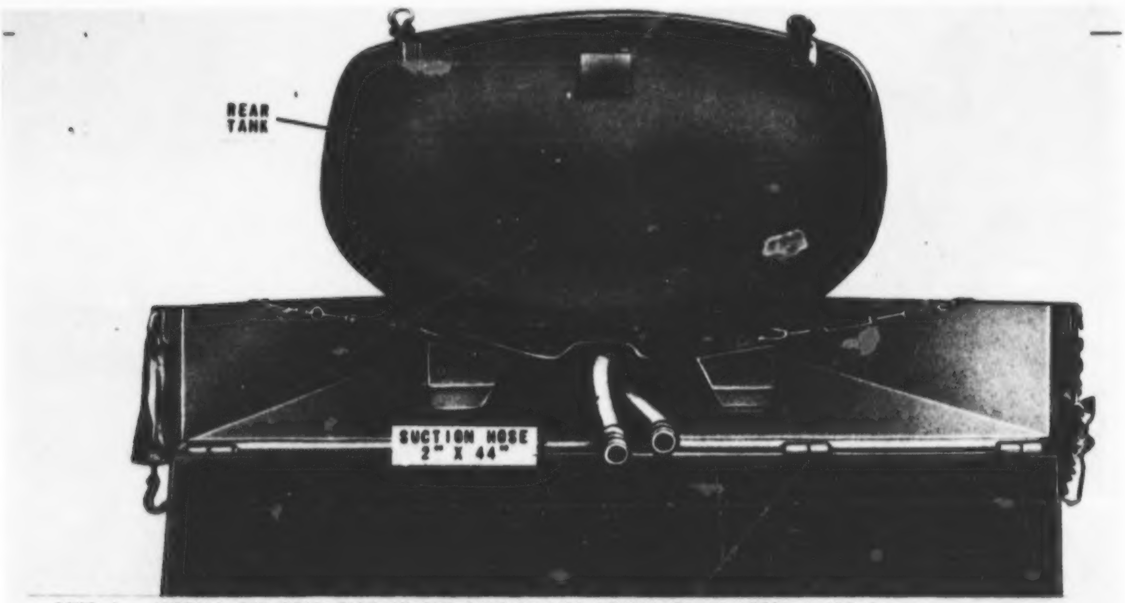
STEP 2. SECURE TANK IN PLACE WITH TIEDOWN ASSEMBLY.

STEP 3. CONNECT THE 2 INCH X 107 INCH HOSE TO THE DISCHARGE VALVE AND CONNECT THE 3/4 INCH X 10FT DRAIN HOSE (NOT SHOWN) TO THE DRAIN VALVE ELBOW (NOT SHOWN) OF THE FRONT TANK.

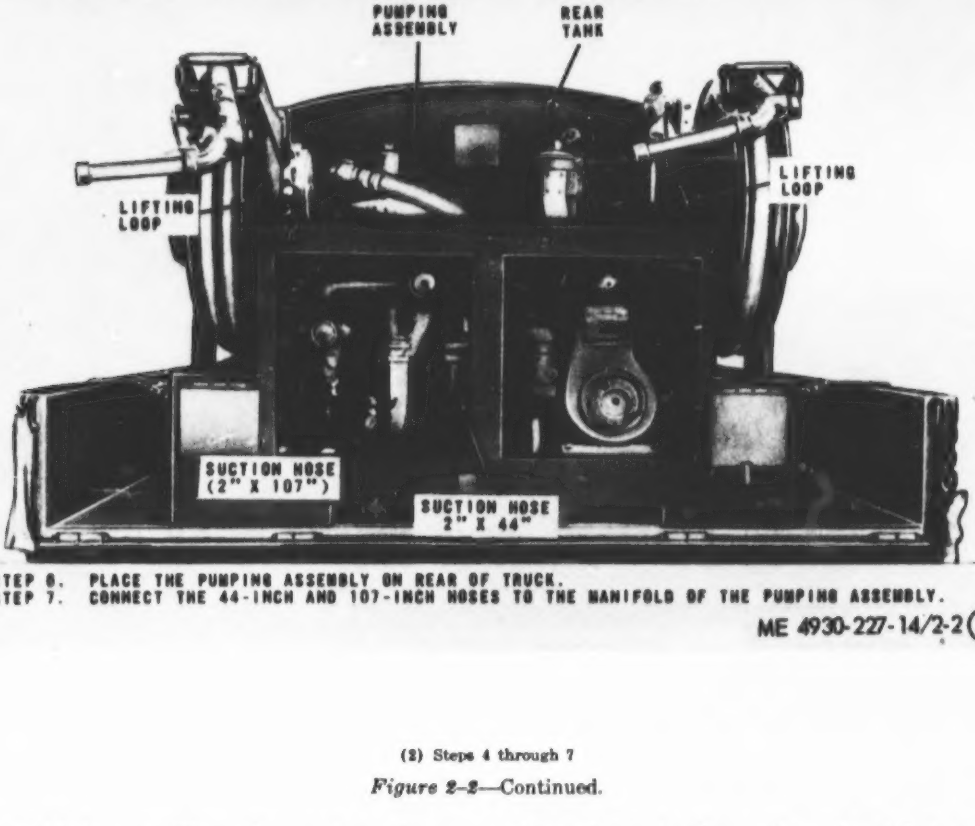
ME 4930-227-14/2-2 ①

(1) Steps 1 through 3

Figure 2-2. Installing tanks and pump in truck.


REAR TANK
SUCTION HOSE 2" X 44"

STEP 4. INSTALL THE REAR TANK IN THE SAME MANNER DESCRIBED IN STEPS 1 AND 2.
STEP 5. INSTALL THE 2 INCH X 44 INCH HOSE ON THE DISCHARGE VALVE AND THE 3/4 INCH X 5FT HOSE (NOT SHOWN) ON THE DRAIN VALVE ELBOW (NOT SHOWN) OF THE REAR TANK.


PUMPING ASSEMBLY
REAR TANK
LIFTING LOOP
LIFTING LOOP
SUCTION HOSE (2" X 107")
SUCTION HOSE 2" X 44"

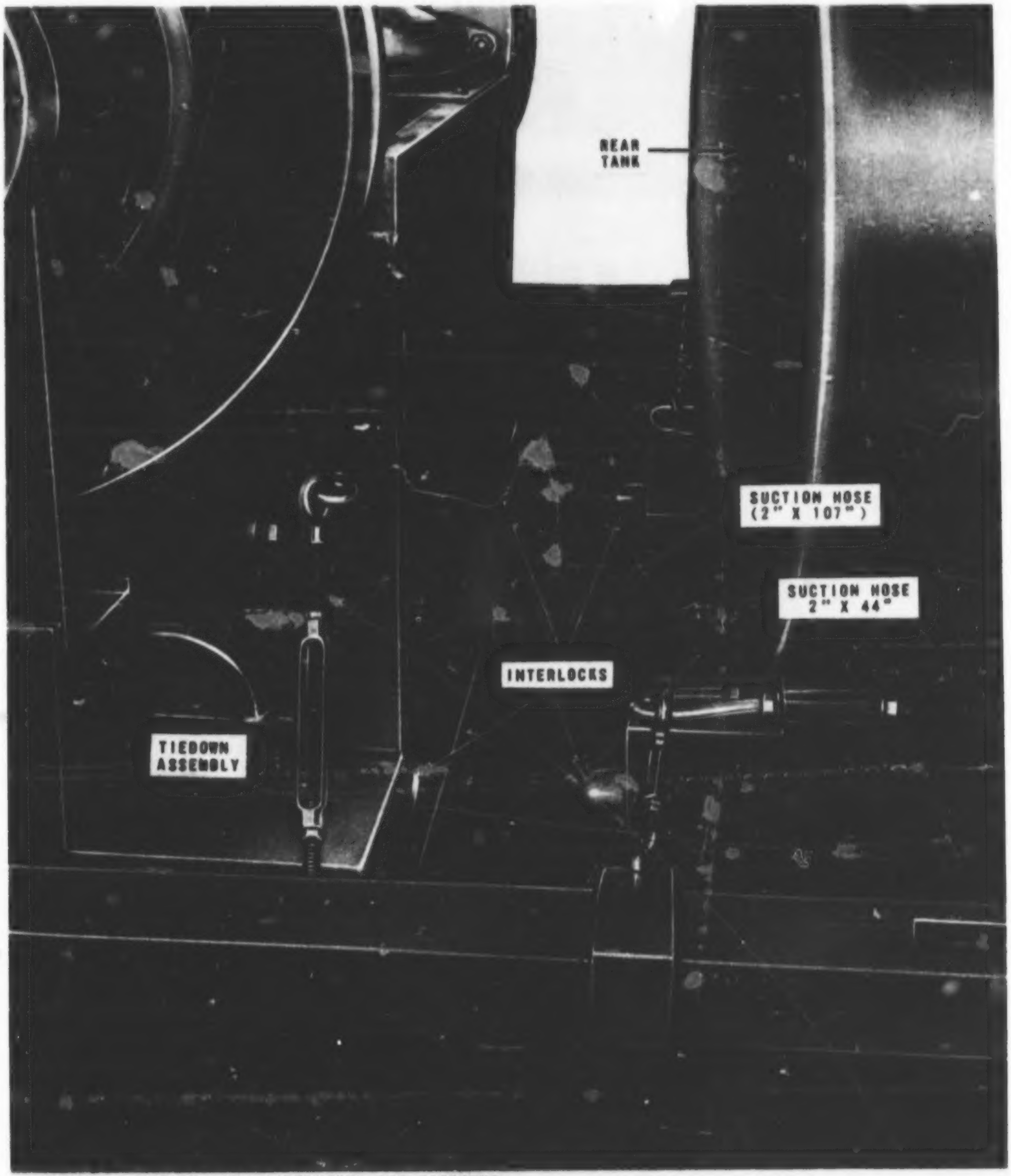
STEP 6. PLACE THE PUMPING ASSEMBLY ON REAR OF TRUCK.
STEP 7. CONNECT THE 44-INCH AND 107-INCH HOSES TO THE MANIFOLD OF THE PUMPING ASSEMBLY.

ME 4930-227-14/2-2 ②

(2) Steps 4 through 7

Figure 2-2—Continued.

(3) To aid in unrolling the nylon strap, turn ratchet hook opening down on a flat surface. Press down in the center of ratchet, while pulling nylon strap away from ratchet.


REAR TANK
SUCTION HOSE (2" X 107")
SUCTION HOSE 2" X 44"
INTERLOCKS
TIEDOWN ASSEMBLY

STEP 8. SECURE WITH INTERLOCKS AND TIEDOWNS.

ME 4930-227-14/2-2③

(3) Step 8

Figure 2-2—Continued.

(4) Refer to figure 2-4 and place tiedown straps over tank ends. Attach brackets to sides of truck. Connect strap end and ratchet to brackets. Move ratchet handle up and down until strap is tight. Push ratchet handle to the lock position.

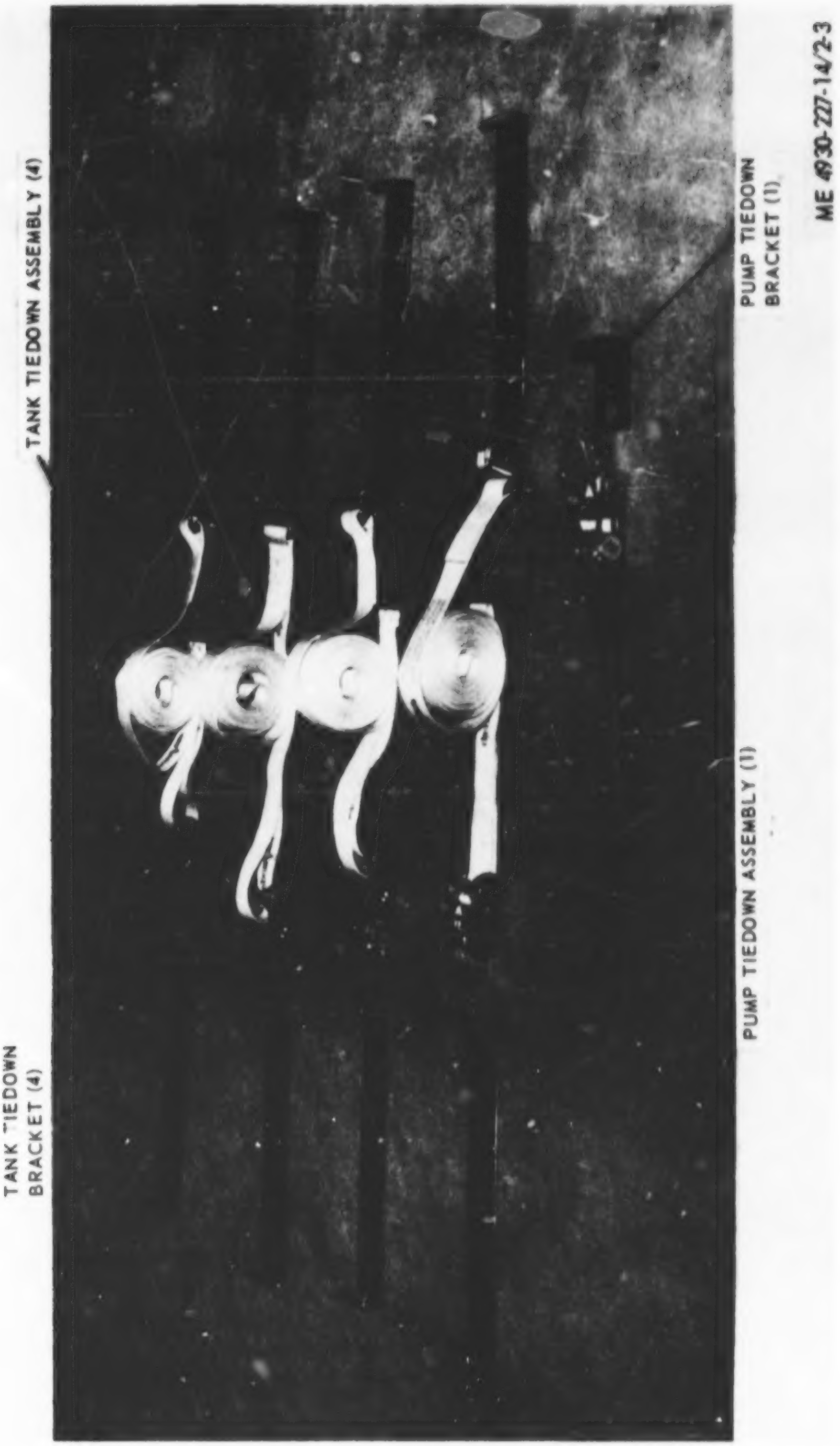

TANK TIEDOWN BRACKET (4)
TANK TIEDOWN ASSEMBLY (4)
PUMP TIEDOWN ASSEMBLY (1)
PUMP TIEDOWN BRACKET (1)
ME 4930-227-14/2-3

Figure 2-3. Tank and pump unit vertical tiedown strap assembly.

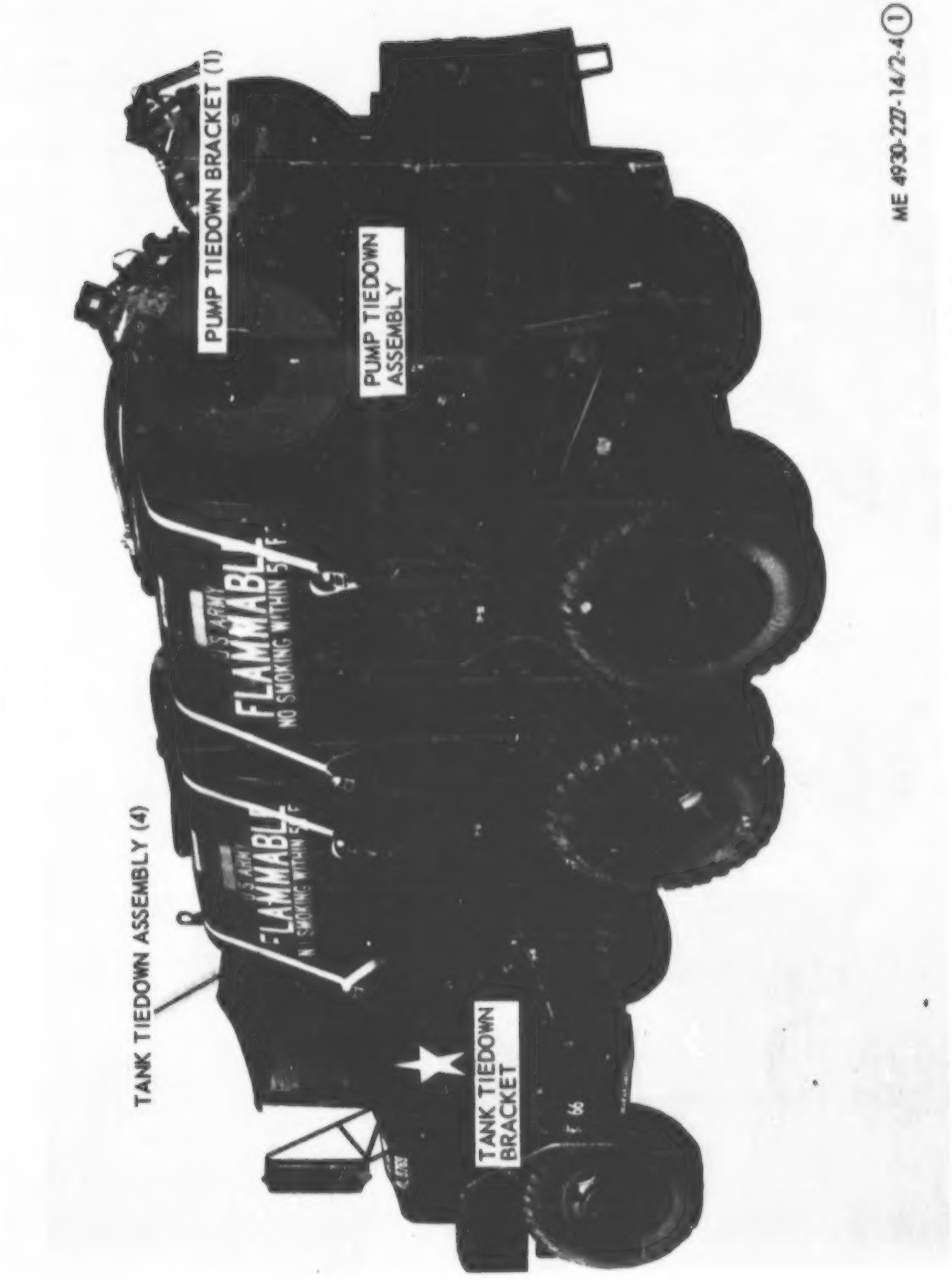

PUMP TIEDOWN BRACKET (1)
PUMP TIEDOWN ASSEMBLY
TANK TIEDOWN ASSEMBLY (4)
TANK TIEDOWN BRACKET
U.S. ARMY
FLAMMABLE
NO SMOKING WITHIN 50 F
ME 4930-227-14/2-4 ①

Figure 2-4(1). Tank and pump unit vertical tiedown strap assembly installed.

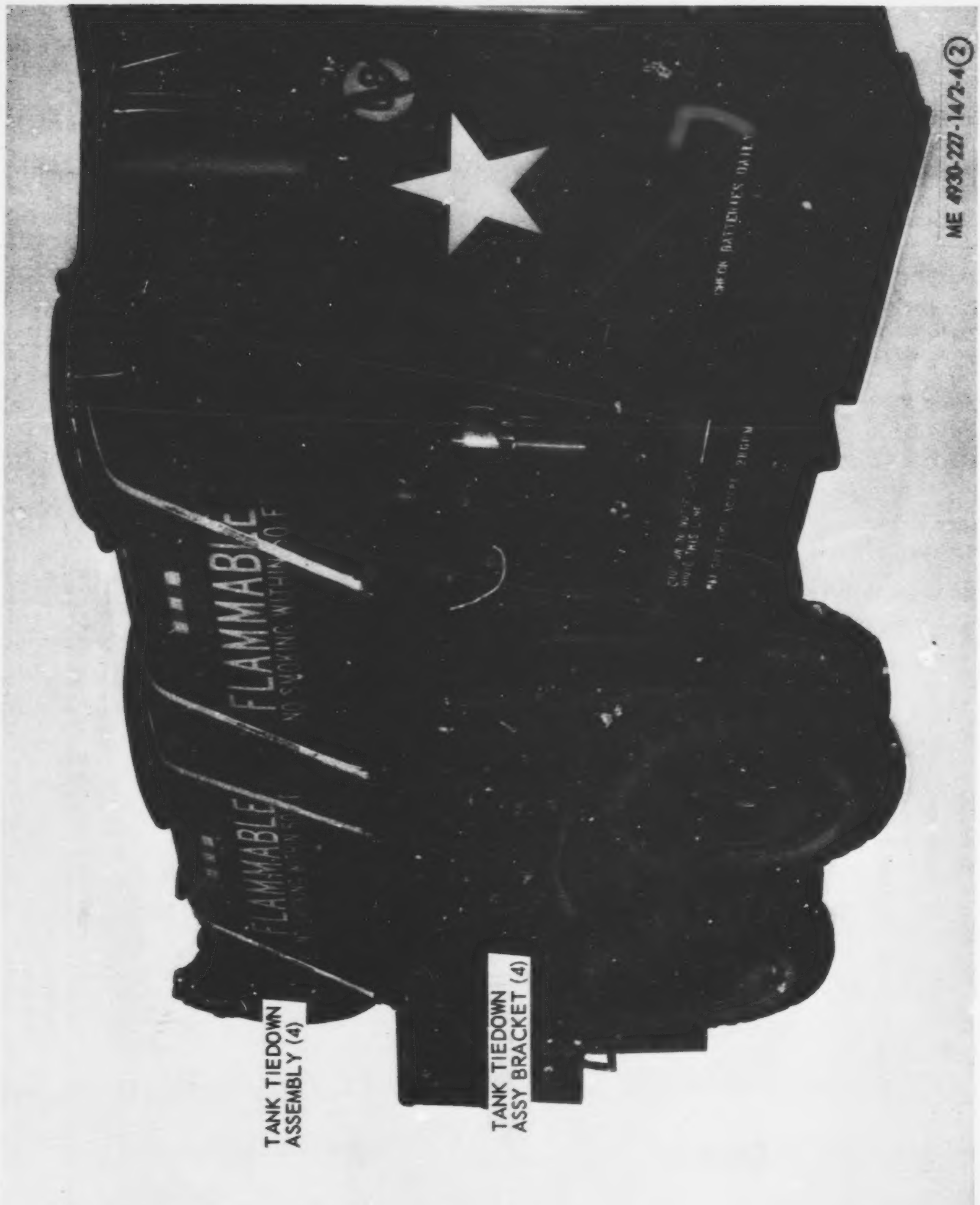

TANK TIEDOWN ASSEMBLY (4)
TANK TIEDOWN ASSY BRACKET (4)
FLAMMABLE
FLAMMABLE
NO SMOKING WITHIN 50 F
ME 4930-227-14/2-4 ②

Figure 2-4 (2)—Continued.

best copy available

d. Pump Unit Rear Tiedown Strap Assembly.

(1) Refer to figure 2-3 for identification of tiedown strap assembly.

(2) Refer to figure 2-4 and hook loose bracket over top of reel frame, long side with hole out and down. Hook bracket attached to strap end beneath rear truck from 8 to 10 inches right of center.

(3) Pass strap end up through space between tailgate and truck body. Insert strap end, rear to front, thru slot in center of ratchet spool. Pull all slack thru ratchet spool by strap end.

(4) Unlock ratchet, move ratchet handle in an up and down motion until strap is tight. Push ratchet handle to closed position.

(5) Raise the tailgate.

Section II. MOVEMENT TO A NEW WORKSITE

2-4. Dismantling for Movement

a. Short Distance Movement.

(1) Remove the tanks and pump unit from the truck with a forklift or other suitable device.

(2) Move the tanks and pump unit to the new worksite with the forklift or vehicle. Provide suitable blocking and tiedowns to prevent the equipment from shifting.

b. Long Distance Movement.

(1) Provide a suitable container for the tanks and pump unit. Refer to TM 38-230 for instructions in container fabrication.

(2) Provide suitable blocking and tiedowns to prevent the unit from shifting during transport.

2-5. Reinstallation After Movement

Reinstall the tanks and pump unit after movement to a new worksite as instructed in paragraph 2-3.

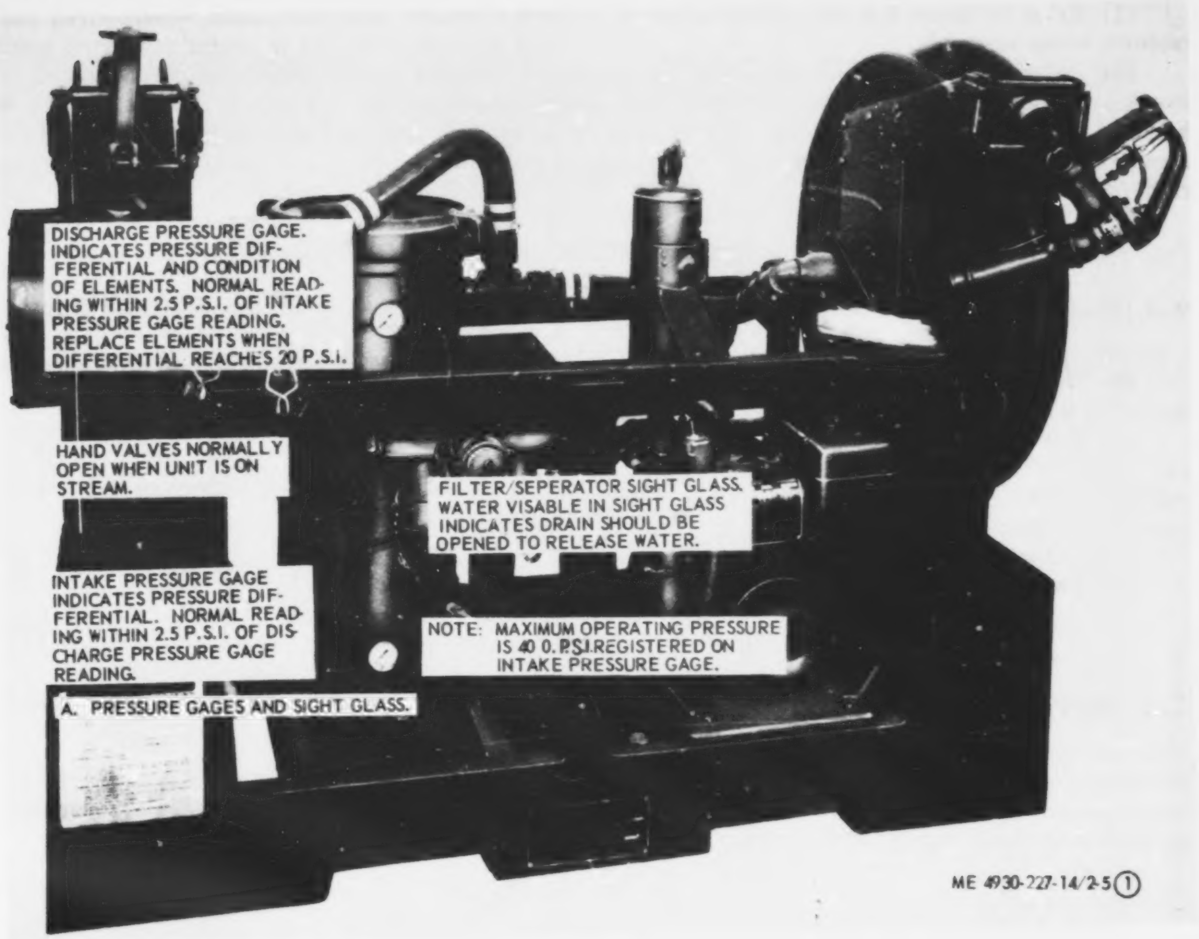
Section III. CONTROLS AND INSTRUCTIONS

2-6. General

This section describes, locates, illustrates, and furnishes the operator, crew, or organizational maintenance personnel, sufficient information about the various controls and instruments for proper operation of the tanks and pump unit.

2-7. Controls and Instruments

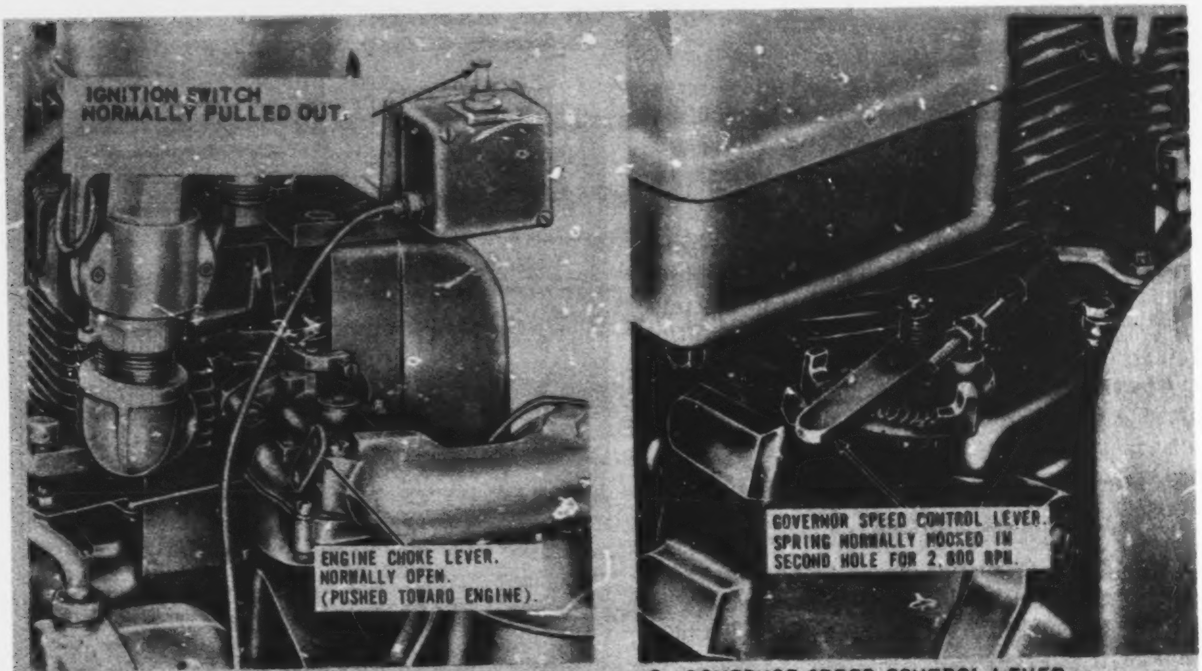
The purpose of the controls and instruments and the normal and maximum reading of the instruments are illustrated in figure 2-5.


DISCHARGE PRESSURE GAGE. INDICATES PRESSURE DIFFERENTIAL AND CONDITION OF ELEMENTS. NORMAL READING WITHIN 2.5 P.S.I. OF INTAKE PRESSURE GAGE READING. REPLACE ELEMENTS WHEN DIFFERENTIAL REACHES 20 P.S.I.
HAND VALVES NORMALLY OPEN WHEN UNIT IS ON STREAM.
FILTER/SEPERATOR SIGHT GLASS. WATER VISABLE IN SIGHT GLASS INDICATES DRAIN SHOULD BE OPENED TO RELEASE WATER.
INTAKE PRESSURE GAGE INDICATES PRESSURE DIFFERENTIAL. NORMAL READING WITHIN 2.5 P.S.I. OF DISCHARGE PRESSURE GAGE READING.
NOTE: MAXIMUM OPERATING PRESSURE IS 40 0. P.S.I. REGISTERED ON INTAKE PRESSURE GAGE.
A. PRESSURE GAGES AND SIGHT GLASS.

ME 4930-227-14/2-5 ①

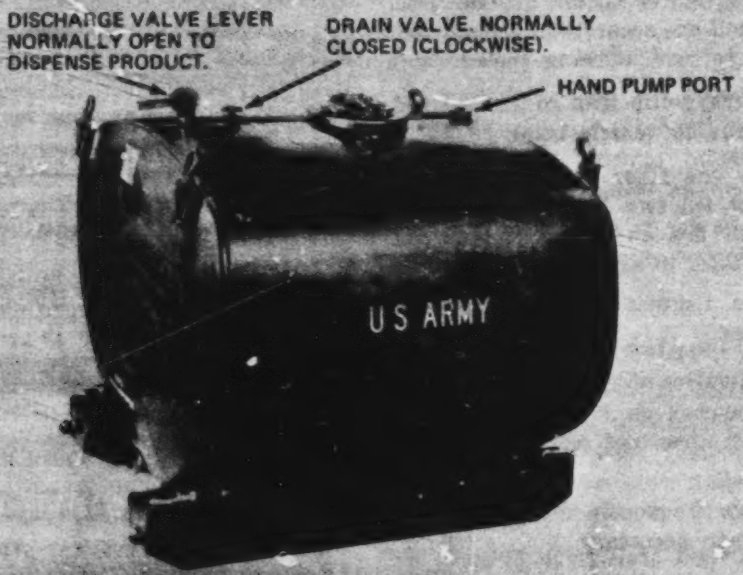
(1) Reference A

Figure 2-5. Controls and instruments.


IGNITION SWITCH NORMALLY PULLED OUT.
ENGINE CHOKE LEVER. NORMALLY OPEN. (PUSHED TOWARD ENGINE).
GOVERNOR SPEED CONTROL LEVER. SPRING NORMALLY HOOKED IN SECOND HOLE FOR 2,800 RPM.

B. ENGINE CHOKE LEVER AND IGNITION SWITCH.

C. GOVERNOR SPEED CONTROL LEVER.


DISCHARGE VALVE LEVER NORMALLY OPEN TO DISPENSE PRODUCT.
DRAIN VALVE. NORMALLY CLOSED (CLOCKWISE).
HAND PUMP PORT
US ARMY

D. TANK DRAIN VALVE, AND DISCHARGE VALVE LEVER.

ME 4930-227-14/2-5②

(2) References B through D

Figure 2-5—Continued.

Section IV. OPERATION OF EQUIPMENT

2-8. General

a. The instructions in this section are published for the information and guidance of the personnel responsible for the operation of the tank and pump unit.

b. The operator must know how to perform capable. This section gives instructions on starting, stopping, and operating details of the tank and pump unit. Since nearly every application presents a different problem, the operator may have to vary given procedures to fit the individual job.

2-9. Starting

a. Preparation for Starting.

(1) See that suction hoses connecting tanks to pumping assembly are properly secured. Group pumping assembly before opening the filler plug of a tank.

(2) Drive ground rod into earth near assembly.

(3) Pull ground wires from ground reel (fig. 1-2) and ground one securely to ground rod. Attach other wire to vehicle being fueled.

***Caution:* Always clip lead to ground rod before attaching lead to vehicle being fueled.**

(4) Open only the filler plug of the tank being filled. Do not fill two tanks at the same time unless operator has an assistant. Do not overfill the tanks. Refer to safety precautions.

(5) Maintain a distance of 25 feet between vehicles being fueled.

(6) Open hand-valves of sight glass assembly (fig. 2-5). Open petcock on lower valve to release air if product does not appear in sight glass.

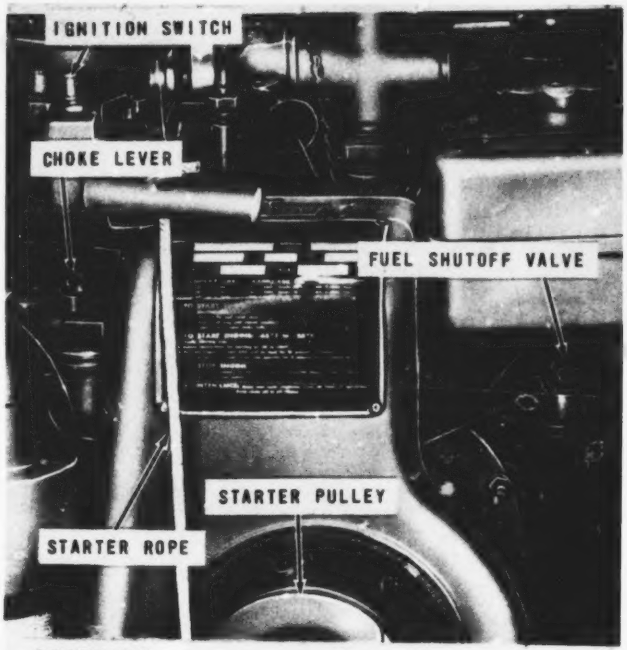
(7) Check glass frequently for presence of water and drain when necessary.

Note. A petcock is located at the bottom of the left side of the filter/separator.

(8) Prime pump through priming port (fig. 1-4), if necessary.

Note. Priming should not be necessary when tanks are full.

b. Starting. Refer to figure 2-6 and start the engine.



STARTING:
STEP 1. OPEN FUEL SHUTOFF VALVE (TURN COUNTERCLOCKWISE).
STEP 2. PULL IGNITION SWITCH OUT.
STEP 3. PULL OUT CHOKE LEVER TO CLOSE CHOKE.
STEP 4. WIND ROPE CLOCKWISE AROUND PULLEY AND PULL SHARPLY.
STEP 5. OPEN CHOKE HALFWAY, REWIND ROPE, AND PULL HARD AGAIN. UNDER NORMAL CONDITIONS, ENGINE SHOULD START AFTER ONE OR TWO ATTEMPTS.
STEP 6. ALLOW ENGINE TO RUN AT MODERATE SPEED FOR SEVERAL MINUTES TO WARM UP.
FULLY OPEN CHOKE
CAUTION: NEVER RACE THE ENGINE DURING WARM-UP PERIOD.

ME 4930-227-14/2-6

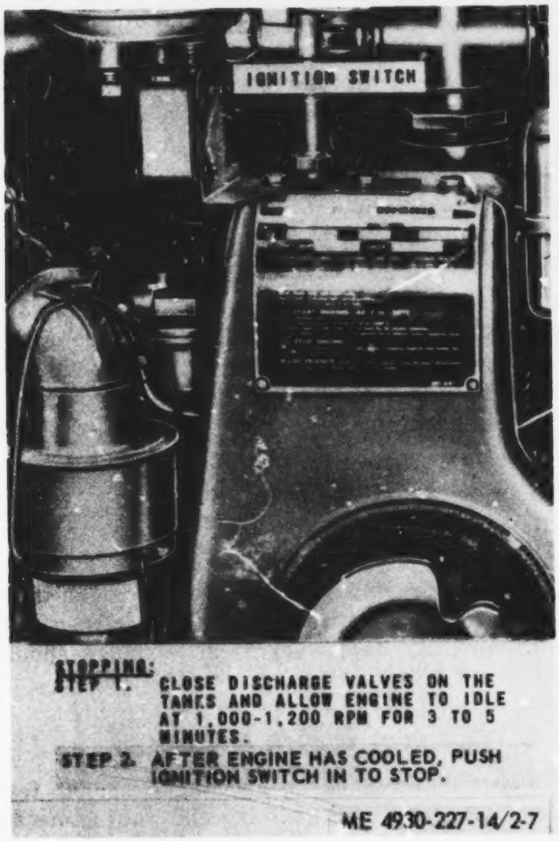
Figure 2-6. Engine starting instructions.

2-10. Stopping

Refer to figure 2-7 and stop the engine.

2-11. Unit Operation

a. General. The tank and pump unit can be used to dispense all types of automotive and aviation fuels. However, only one grade of fuel should be carried in and dispensed from the unit at a time. Since the pumping assembly is highly adaptable, dispensing with the tank and pump



STOPPING:
STEP 1. CLOSE DISCHARGE VALVES ON THE TANKS AND ALLOW ENGINE TO IDLE AT 1,000-1,200 RPM FOR 3 TO 5 MINUTES.
STEP 2. AFTER ENGINE HAS COOLED, PUSH IGNITION SWITCH IN TO STOP.

ME 4930-227-14/2-7

Figure 2-7. Engine stopping instructions.

unit may be done in a variety of ways to meet different situations in the field. This paragraph covers some common operational procedures for the tank and pump unit in the field.

Note. All aircraft fuel must be dispensed through a filter/separator unit.

***Warning:* Be sure proper grounding procedures have been followed prior to performing any of the following operations; use only high octane fuel for aircraft.**

b. *Dispension from Truck Tanks Through Reels.*

(1) Lower tailgate and ground the unit; attach one end of the ground wire to the aircraft or vehicle to be fueled.

(2) Attach nozzles and pull out dispensing hoses to desired length; use both hoses if the operator has an assistant. Attach nozzle bonding wires (fig. 1-3) to aircraft or vehicle before opening filler caps and inserting nozzles.

(3) Insert nozzles in vehicle or equipment fuel tanks carefully, but firmly, to form a bond; observe safe fueling rates stenciled near fuel tanks carefully, but firmly, to form a bond; observe safe fueling rates stenciled near fuel tanks.

***Caution:* When dispensing fuel, attend the nozzles constantly; do not wedge open or block the control lever.**

(4) Open a tank discharge valve and start pump. Opening a discharge valve with full tanks should prime the pump.

(5) Be sure that fuel to be dispensed to an aircraft is the same grade as that stenciled near the aircraft filler caps; note tank capacities and ask the pilot or flight engineer for estimate of quantities needed, to avoid spillage.

Note. Do not leave nozzles unattended during refueling.

***Caution:* Replace filler cap securely before removing the nozzle bonding wire.**

Note. Recap, wind and secure nozzle bonding wire around nozzles when through dispensing.

(6) Open second discharge valve just before first tank is emptied, and close first discharge valve when the tank is empty.

(7) Stop pump when operation is completed; drain hoses if shutting down for longer than overnight; rewind hoses, rewind ground wire and remove nozzles and stow.

(8) Refill tanks at the end of the day's operation to reduce condensation during overnight storage.

2-12. Operation in Extreme Cold

a. *General.* In extreme cold weather it may be necessary to reduce the volume of cooling air flowing through the engine. This may be accomplished by obstructing the air intake at the flywheel. Exercise care not to cause engine overheating.

b. *Fuel System.* Keep the fuel tank full to reduce condensation of moisture inside the tank. Clean the fuel filter bowl more frequently. Keep the fuel tank cap free of ice and snow.

c. *Ignition System.* Before starting, remove all accumulated snow and ice from the spark plug, ignition cable and magneto.

***Warning:* Do not touch metal parts with bare hands in extremely cold weather.**

2-13. Operation in Extreme Heat

a. General. Accumulated dirt on engine reduces radiation of heat. Keep the unit clean to avoid overheating.

b. Cooling System.

(1) Keep the engine cooling fins clean.

(2) Keep all exposed surfaces of the engine clean.

(3) Remove all obstructions to the flow of air across the engine.

c. Lubrication. Refer to lubrication order, LO 5-4930-227-12.

d. Pumping Unit. Where possible, operate the pumping unit in the shade to avoid overheating and do not run the engine too hard. If the engine overheats, remove the load and idle the engine at 1,000 rpm for five minutes. If fuel vapor lock occurs, wait until the engine cools off.

e. Tanks and Hoses. Locate the tanks in the shade, where possible, and wet down with water to reduce heat.

2-14. Operation in Dusty or Sandy Areas

a. Protection. Take advantage of natural barriers to blowing sand and dust; or, if necessary, erect artificial barriers.

b. Air Cleaner. Service the air cleaner frequently (para 3-27).

c. Filter/Separator Element. Service the filter/separator frequently (para 3-11).

d. Cleaning. Clean the tank and pump unit with an approved cleaning solvent, giving special attention to cavities, corners, and partially exposed interior spaces. Dry thoroughly. Keep the tank and areas around the discharge valve and controls free from sand and dust.

2-15. Operation Under Rainy or Humid Conditions

When the unit is outside and not operating, protect it with a canvas or other waterproof cover. Remove the cover during dry periods to allow the unit to dry out. Keep the fuel tank full to prevent the forming of condensate. Give special care to keeping all components free from moisture. Clean and paint all surfaces not otherwise protected.

2-16. Operation in Salt Water Areas

Salt water corrodes metal. If unpainted equipment parts are exposed to salt water, clean them off immediately with an approved cleaning solvent, and dry thoroughly. All surfaces should be cleaned daily.

2-17. Operation at High Altitudes

The unit is designed to operate at 8,000 feet above sea level without special adjustments. However, at higher altitudes, the carburetor may require adjustment (para 3-28).

Section V. OPERATION OF AUXILIARY MATERIEL USED IN CONJUNCTION WITH THE TANK AND PUMP UNIT

2-18. General

This section contains information on the fire extinguishers and the fueling meter. The dry-chemical type fire extinguisher (para 2-19) is a nonshatterable, hand-type extinguisher. The fueling meter is a volumetric, positive-displacement, liquid-measuring device, used when refueling aircraft or any vehicle which requires a specific measurement of the product. It is equipped with a five-figure reset counter and a nonsetback totalizer that registers to 9,999,999 gallons.

2-19. Fire Extinguisher (Dry-Chemical Type)

a. Description. The dry-chemical type fire extinguisher is suitable for electrical and flammable liquid fires.

b. Operation. Remove fire extinguisher from mounting bracket. Release nozzle from holster. Pull pin. Press lever all the way down to pressurive extinguisher. Hold extinguisher upright, squeeze nozzle lever to fully open and direct discharge at base of flame, using rapid side-to-side sweeping motion. Always keep flames ahead of dry chemical charge.

2-20. Metering Kit

A metering kit, FSN 4930-088-7665, is available for pumping assemblies on an as required basis.

2-21. Meter Register Operation

To reset indicating wheels to zero, push in and turn reset knob on right side of register.

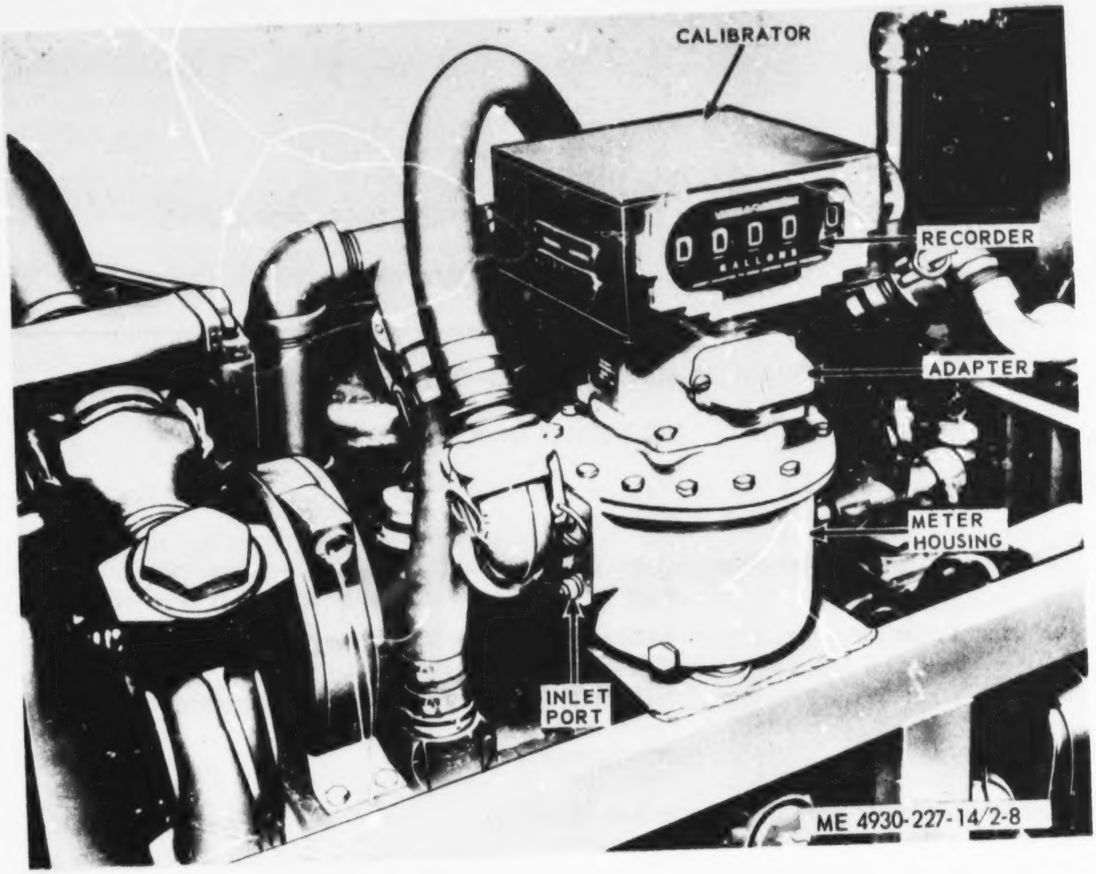

CALIBRATOR
RECORDER
ADAPTER
METER HOUSING
INLET PORT
ME 4930-227-14/2-8

Figure 2-8. Metering kit.

Caution: **Do not start delivery unless shutter is in full open position. If numbers on indicating wheels are not in full view, resetting operation has not been completed; in which case, turn reset knob until shutter disappears and reset knob returns to its normal position. Adjustments or repairs will be accomplished by direct support maintenance personnel.**

CHAPTER 3

OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR AND ORGANIZATIONAL MAINTENANCE

TOOLS AND EQUIPMENT

3-1. Tools and Equipment

a. Basic issue tools and repair parts issued with or authorized for the tank and pump unit are listed in the basic issue items list, appendix C of this manual.

b. No special tools or equipment are required by the operator or organizational maintenance personnel for the maintenance of the tank and pump unit.

3-2. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-4930-227-24P (when printed).

Section II. LUBRICATION

3-3. General Lubrication

Refer to Lubrication Order, LO 5-4930-227-12, for general lubrication.

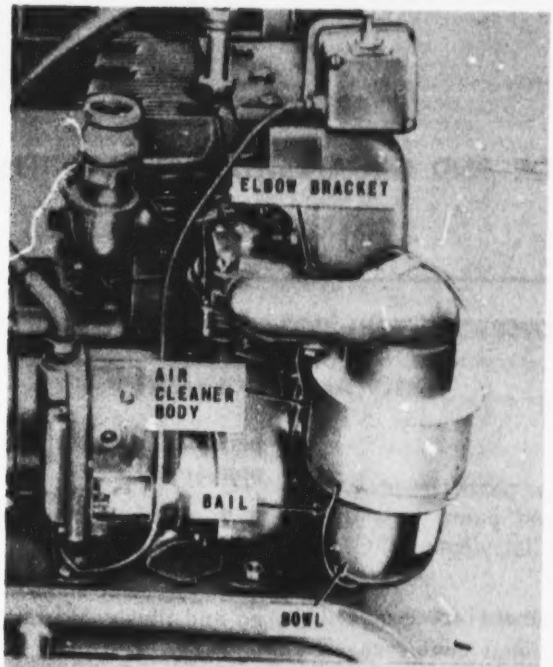
3-4. Detailed Lubrication

a. Care of Lubrication. Keep all lubricants in closed containers and store in a clean, dry place, away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. Cleaning. Keep all external parts not requiring lubrication free from lubricants. Before lubricating the equipment, wipe all lubrication points free of oil, dirt and grease. Clean all lubrication points after lubricating to prevent the accumulation of foreign matter.

c. Operation Immediately After Lubrication. Operate the engine immediately after lubrication. Inspect the engine for oil leaks. If the crankcase oil has been changed, operate the engine for approximately 5 minutes before checking the oil level.

d. Air Cleaner Service. Refer to figure 3-1 and service the air cleaner.



STEP 1. RELEASE BAIL AND REMOVE BOWL. EMPTY OIL FROM BOWL AND LIFT BAFFLE FROM BOWL. CLEAN BOWL AND BAFFLE WITH APPROVED CLEANING SOLVENT AND DRY THOROUGHLY.

STEP 2. RELEASE BAIL AND REMOVE AIR CLEANER BODY FROM ELBOW BRACKET. FLUSH ELEMENT WITH CLEANING SOLVENT AND SHAKE DRY.

NOTE: DO NOT REMOVE ELEMENT FROM AIR CLEANER BODY.

STEP 3. SECURE AIR CLEANER BODY TO BRACKET WITH BAIL.

STEP 4. REFILL BOWL WITH OIL TO LEVEL LINE ON BAFFLE. REPLACE BOWL ON AIR CLEANER BODY AND SECURE WITH BAIL.

ME 4930-227-14/3-1

Figure 3-1. Air cleaner service..

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-5. General

To insure the tank and pump unit is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 3-6. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operations of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-6. Preventive Maintenance Checks and Services

a. Table 3-1 contains a tabulated list of preventive checks and services which must be performed by the operator and organizational maintenance personnel.

b. The interval column designates the maintenance level and required service interval. A quarterly interval is equal to 3 calendar months or 250 hours of operation, whichever occurs first.

c. Refer to table 3-1 for the preventive maintenance checks and services.

Table 3-1. Preventive Maintenance Checks and Services.

Item number	Interval						B—Before operation D—During operation	A—After operation W—Weekly	M—Monthly Q—Quarterly
	Operator				Org.				
	Daily				M	Q	Item to be inspected	Procedure	Reference
	B	D	A	W					
1	X	X	X	X	X	X	Hoses, nozzles and reels	Check hoses for leaks, breaks, cracks, cuts, and worn areas. Replace leaking, worn or damaged hose. Check nozzles for distortion, corrosion and leaks. Clean or replace distorted, corroded, or leaking nozzles. Check reels for alinement and ease of operation.	Para 3-35
2	X	X	X	X	X	X	Grounding cable and reel	Check cable for worn, frayed or corroded condition. Check reel for ease of operation. Replace worn, frayed or corroded cable and clips.	Para 3-37
3	X					X	Magneto	Replace pitted or burned magneto points. Proper gap adjustment is 0.015 inch.	Para 3-24
4		X	X	X	X	X	Filter/separator	Check for leaks, cracks, or other damage. Check for leaking, cracked or dirty sight glass. Remove and clean a dirty sight glass. Replace washers to correct leaking condition. Replace cracked or broken sight glass. Drain water as required. Observe pressure gages during operation. Replace filter elements when discharge pressure (upper) gage has pressure reading of 20 psi less than inlet gage (lower) with engine at full throttle and both nozzles open.	Para 3-34
5	X					X	Spark plugs	Replace spark plugs that have cracked insulators and burned electrodes. Clean and set spark plug gap for 0.030 in. Replace leads which are frayed or broken. Clean and tighten lead connections.	Para 3-23
6	X		X	X	X	X	Fuel tank	Add fuel as required. Tighten loose mounting. Replace leaking fuel tank. Replace defective cap gasket. Clean cap vent.	Para 3-25
7	X		X	X	X	X	Fuel filter	Tighten thumb nut if gasket is leaking. Clean screen.	Para 3-26
8	X	X	X	X	X	X	Oil level gage	Add oil as indicated by level gage.	LO 5-4930-227-12
9	X	X	X	X	X	X	Inlet strainer screen	Check screen for dirt or damage. Clean or replace a dirty or damaged screen.	Para 3-45
10	X		X	X	X	X	Discharge valve and control lever.	Check control lever for binding or damage. Check valve for leaks. Replace damaged control lever. Tighten or replace a leaking valve.	Para 3-45
11	X		X	X	X	X	Air vent assembly	Check vent assembly for dirt or damage. Clean or replace a dirty or damaged vent assembly.	Para 3-42

Section IV. OPERATOR'S MAINTENANCE

3-7. General

The instructions in this section are published for the information and guidance of the operator to maintain the tank and pump unit.

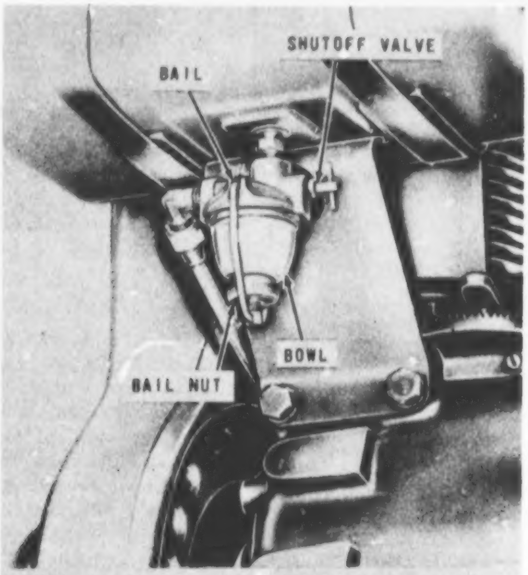
3-8. Fuel Strainer Service

Refer to figure 3-2 and service the fuel strainer.

3-9. Filter/Separator Service

Refer to figure 3-3 and service the filter/separator.

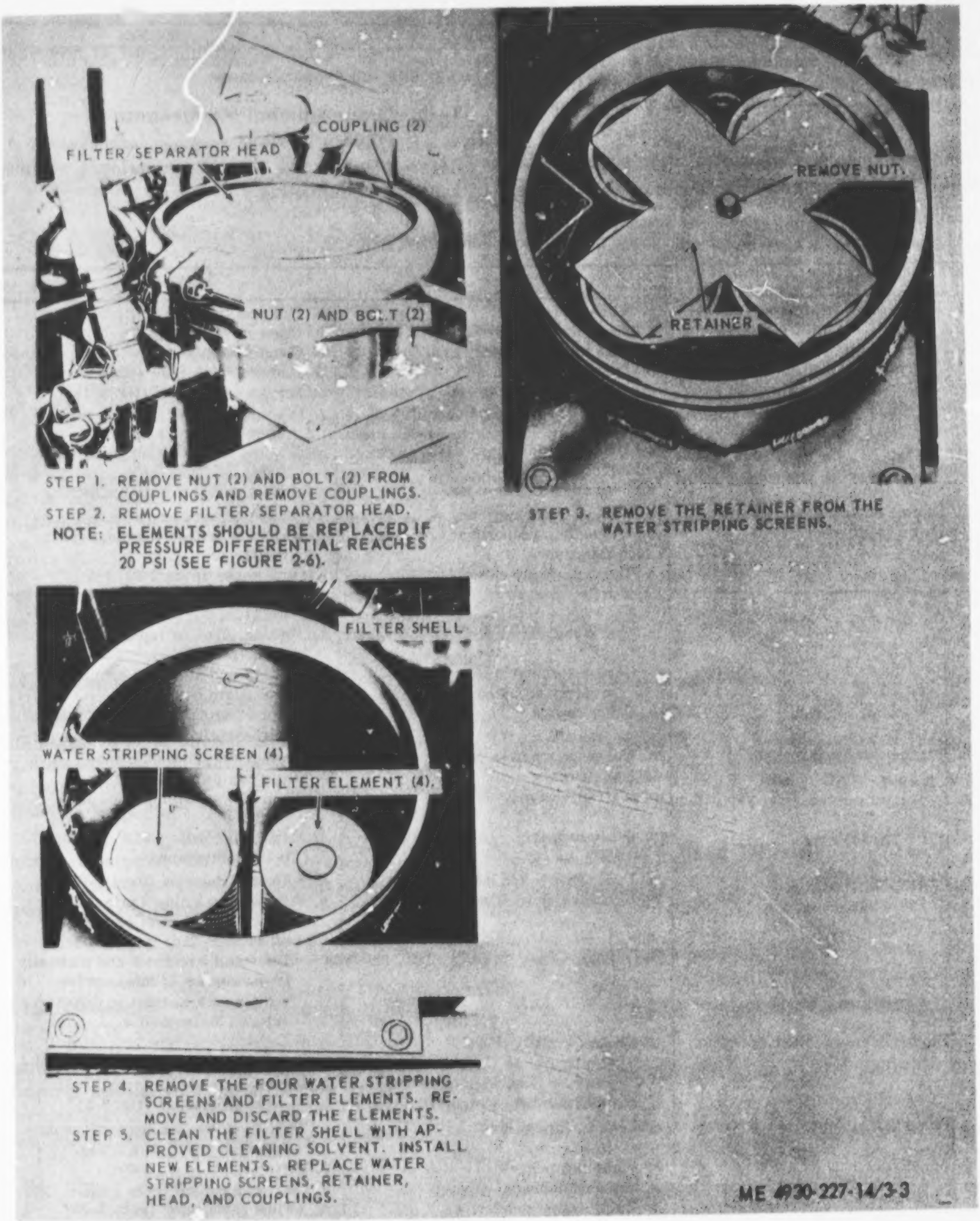
Caution: **Release all pressure, and drain separator, then use rubber gloves.**



STEP 1. CLOSE SHUTOFF VALVE.
STEP 2. LOOSEN BAIL NUT AND RELEASE BAIL.
STEP 3. REMOVE BOWL, GASKET, AND SCREEN AND EMPTY CONTENTS FROM BOWL.
STEP 4. CLEAN BOWL AND SCREEN WITH APPROVED CLEANING SOLVENT AND WIPE DRY.
STEP 5. REPLACE THE SCREEN, GASKET, AND BOWL, AND SECURE IN PLACE WITH BAIL. TIGHTEN BAIL NUT.
STEP 6. OPEN SHUTOFF VALVE.

ME 4930-227-14/3-2

Figure 3-2. Fuel strainer service.


COUPLING (2)
FILTER SEPARATOR HEAD
NUT (2) AND BOLT (2)
REMOVE NUT.
RETAINER
FILTER SHELL
WATER STRIPPING SCREEN (4)
FILTER ELEMENT (4).
ME 4930-227-14/3-3

STEP 1. REMOVE NUT (2) AND BOLT (2) FROM COUPLINGS AND REMOVE COUPLINGS.
STEP 2. REMOVE FILTER SEPARATOR HEAD.
NOTE: ELEMENTS SHOULD BE REPLACED IF PRESSURE DIFFERENTIAL REACHES 20 PSI (SEE FIGURE 2-6).

STEP 3. REMOVE THE RETAINER FROM THE WATER STRIPPING SCREENS.

STEP 4. REMOVE THE FOUR WATER STRIPPING SCREENS AND FILTER ELEMENTS. REMOVE AND DISCARD THE ELEMENTS.
STEP 5. CLEAN THE FILTER SHELL WITH APPROVED CLEANING SOLVENT. INSTALL NEW ELEMENTS. REPLACE WATER STRIPPING SCREENS, RETAINER, HEAD, AND COUPLINGS.

Figure 3-3. Filter/separator service.

Section V. TROUBLESHOOTING

3-10. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the tank and pump units, or any of their components. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

3-11. Organizational Maintenance Troubleshooting

Refer to table 3-2 for organizational maintenance troubleshooting.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine hard to start or fails to start	*a.* Fuel tank empty	*a.* Fill fuel tank.
	b. Fuel shutoff valve closed	*b.* Open valve (para 2-9).
	c. Fuel line obstructed	*c.* Clean fuel line.
	d. Spark plug defective	*d.* Replace sprak plug (para 3-23).
	e. Air cleaner dirty or too full of oil	*e.* Service air cleaner (fig. 3-1).
	f. Ignition switch or cable defective	*f.* Replace defective ignition switch or cable (para 3-23).
	g. Magneto improperly timed or defective	*g.* Re-time or replace magneto (para 3-24).
	h. Fuel mixture improper	*h.* Adjust carburetor (para 3-28).
2. Engine misses, operates erratically or loses power	*a.* Fuel mixture improper	*a.* Adjust carburetor (para 3-28).
	b. Magneto improperly adjusted or defective	*b.* Adjust or replace magneto (para 3-24).
	c. Choke partially closed	*c.* Open choke (para 2-7).
	d. Muffler clogged	*d.* Clean or replace muffler (para 3-31).
	e. Spark plug loose, dirty or damaged	*e.* Tighten, clean or replace spark plug (para 3-23).
	f. Governor controls loose or improperly adjusted	*f.* Tighten and adjust governor control (para 3-29).
	g. Other causes	*g.* Refer other causes to direct support maintenance.
3. Engine overheats or knocks	*a.* Ventilation across engine poor	*a.* Provide proper ventilation.
	b. Engine dirty	*b.* Clean engine radiation fins.
	c. Muffler clogged	*c.* Clean or replace muffler (para 3-31).
	d. Other causes	*d.* Refer other causes to direct support maintenance.
4. Engine backfires	*a.* Fuel mixture too lean	*a.* Adjust carburetor (para 3-28).
	b. Intake valve sticking	*b.* Remove spark plug (para 3-23). Pour 1/2 to 1 oz of penetrating oil (VV-P-216) into cylinder. Let stand 5 minutes and manually crank engine. If intake valve remains stuck, refer to direct support maintenance.
5. Engine exhaust smoke excessive	*a.* Choke partially closed	*a.* Open choke (para 2-7).
	b. Fuel mixture too rich	*b.* Adjust carburetor (para 3-28).
	c. Carburetor float sticking or leaking	*c.* Replace carburetor (para 3-28).
	d. Air cleaner dirty or too full	*d.* Service air cleaner (fig. 3-1).
6. Pump fails to operate	*a.* Leak in suction line	*a.* Tighten or replace connections or defective hose (para 3-35).
	b. Pump not primed	*b.* Prime pump (para 2-9).
	c. Impeller damaged or worn	*c.* Replace impeller (para 3-17).
	d. Engine speed too low	*d.* Adjust carburetor (para 3-28).
7. Pump fails to prime	*a.* Leak in suction lines or connections	*a.* Replace suction lines. Tighten loose or leaky connections (para 3-35).
	b. Pump chamber not filled	*b.* Prime pump (para 2-9).
	c. Air leak at mechanical seal	*c.* Replace seal (para 3-17).

Table 3-2—Continued.

Malfunction	Probable cause	Corrective action
8. Pump fails to deliver capacity	*a.* Engine speed too low	*a.* Adjust carburetor (para 3-28).
	b. Air lock in pumping system	*b.* Cool pump and reprime (para 2-9).
	c. Kinked lines	*c.* Check lines.
	d. Clogged impeller	*d.* Check impeller.
9. Pump fails to pump product	*a.* Pump not properly primed	*a.* Prime pump (para 2-9).
	b. Engine speed too low	*b.* Adjust carburetor (para 3-28); adjust governor (para 3-28).
	c. Discharge hose kinked or defective	*c.* Remove kink or replace hose (para 3-35).
	d. Filter/separator clogged	*d.* Check and clean filter/separator (fig. 3-3).
10. Pump noisy	*a.* Foreign matter in pump	*a.* Clean pump (para 3-17).
	b. Impeller worn or out of alinement	*b.* Replace impeller (para 3-17).
	c. Vibrating on base	*c.* Check tiedown gear.
11. Hose reel does not turn easily	*a.* Improper lubrication	*a.* Lubricate fittings in accordance with LO 5-4930-227-12.
	b. Misalined	*b.* Check alinement.
12. Product discharge is not clean	*a.* Contaminated elements	*a.* Replace elements (para 3-9).
	b. Canister loose	*b.* Tighten canister (para 3-9).
	c. Shell dirty on inside	*c.* Clean shell.
13. Flow of product slows down during operation	Leak in hose or connections	Tighten connections or replace hose (para 3-35).
14. No product appears in sight glass	*a.* Upper and lower valves closed	*a.* Open valves (para 2-7).
	b. Air in sight glass	*b.* Open petcock to release air (para 2-9).

Section VI. FIELD EXPEDIENT REPAIRS

3-12. General

Maintenance trouble may occur while the tank and pump unit is operating where repair parts are not available and normal corrective action cannot be performed. When this condition exists, the following expedient repairs may be used in emergencies, upon the decision of the unit Commander. Equipment so repaired must be removed from operation as soon as possible and properly repaired before being placed in operation again.

3-13. Engine Lacks Power

Trouble	Expedient Remedy
Air cleaner clogged or defective	Remove air cleaner (para 3-27) and operate without it. Cover opening with a clean rag.

3-14. Engine Fails to Get Fuel

Fuel line broken ____________	Use industrial tape and tape line at break.

Section VII. PUMP AND ENGINE

3-15. General

The pump and engine unit is mounted on an aluminum frame which will slide out from the pumping assembly. This mounting arrangement provides easy access to the pump and engine for maintenance and servicing purposes.

3-16. Pump and Engine Unit

a. Removal. Refer to figure 3-4 and remove pump and engine unit.

b. Installation. Refer to figure 3-4 and install pump and engine unit.

3-17. Pump and Intermediate Coupling

a. Removal.

(1) Remove the pump and engine unit (para 3-16).

(2) Refer to figure 3-5 and remove the pump and intermediate coupling.

Note. Intermediate coupling cannot be removed until after the pump impeller has been removed from the shaft.

b. Disassembly. Refer to figure 3-6 and disassemble the pump and intermediate coupling.

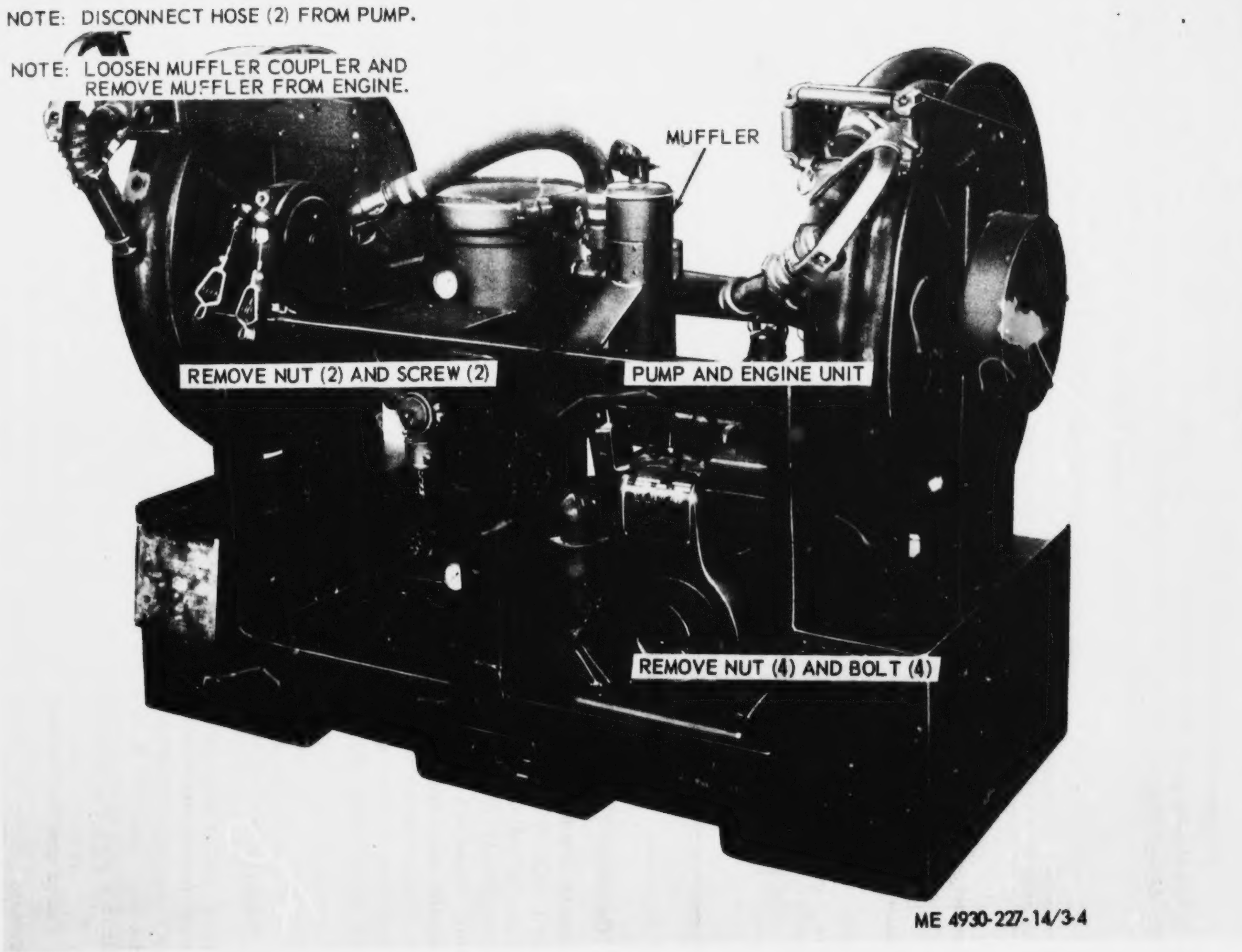

NOTE: DISCONNECT HOSE (2) FROM PUMP.
NOTE: LOOSEN MUFFLER COUPLER AND REMOVE MUFFLER FROM ENGINE.
MUFFLER
REMOVE NUT (2) AND SCREW (2)
PUMP AND ENGINE UNIT
REMOVE NUT (4) AND BOLT (4)
ME 4930-227-14/3-4

Figure 3-4. Pump and engine unit and muffler, removal and installation.

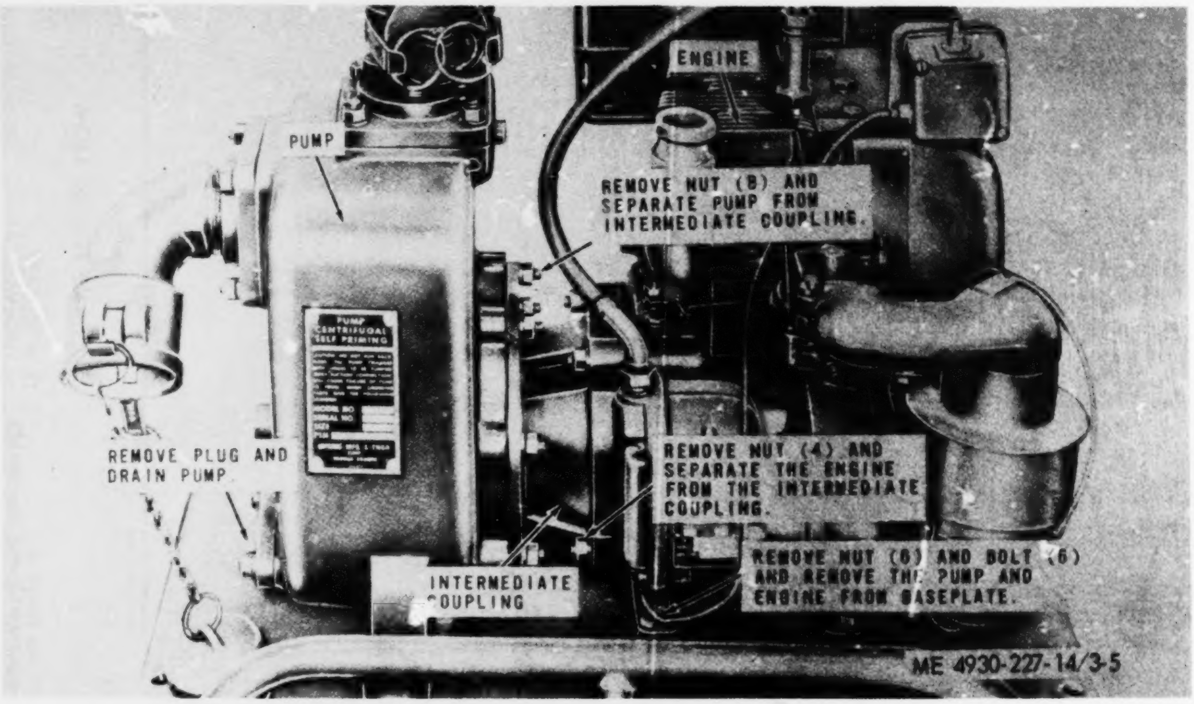

ENGINE
PUMP
REMOVE NUT (3) AND SEPARATE PUMP FROM INTERMEDIATE COUPLING.
REMOVE PLUG AND DRAIN PUMP
REMOVE NUT (4) AND SEPARATE THE ENGINE FROM THE INTERMEDIATE COUPLING.
INTERMEDIATE COUPLING
REMOVE NUT (6) AND BOLT (5) AND REMOVE THE PUMP AND ENGINE FROM BASEPLATE.
ME 4930-227-14/3-5

Figure 3-5. Pump, engine, intermediate coupling and base plate, removal and installation.

c. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

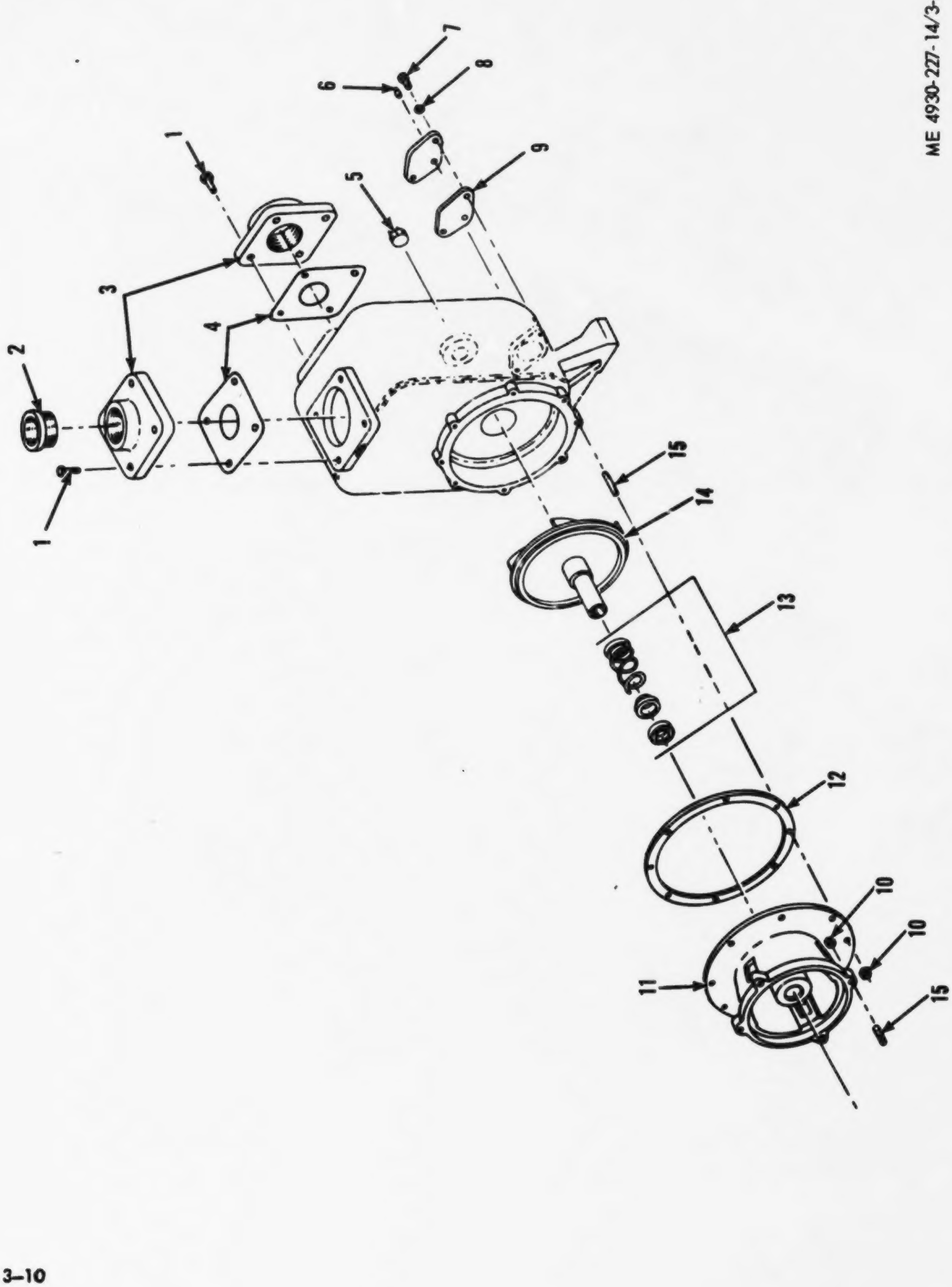
(2) Inspect all parts for cracks, breaks, damaged threads and other defects. Replace a damaged part.

d. Reassembly. Refer to figure 3-6 and reassemble the pump and intermediate coupling.

e. Installation.

(1) Refer to figure 3-5 and install the engine pump and intermediate coupling.

(2) Install the pump and engine unit (para 3-16).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ME 4930-227-14/3-6

Figure 3-6. Pump and intermediate coupling, disassembly and reassembly.

1 Stud (8)
2 Bushing
3 Flange (2)
4 Gasket (2)
5 Plug
6 Plug
7 Stud
8 Washer
9 Gasket
10 Nut (14)
11 Intermediate coupling
12 Gasket
13 Seal assembly
14 Impeller
15 Stud (12)

Figure 3-6—Continued.

Section VIII. ENGINE STARTING AND COOLING SYSTEM

3-18. General

Starting is accomplished by using a pulley and rope arrangement. The engine flywheel acts as a fan, forcing air into the air shroud which distributes this cooling air around the crankcase and cylinder head.

3-19. Starter Pulley

a. Removal. Refer to figure 3-7 and remove the starter pulley.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, damaged threads, and other defects. Replace a damaged part.

c. Installation. Refer to figure 3-7 and install the starter pulley.

3-20. Air Shroud

a. Removal.

(1) Remove the starter pulley (para 3-19).

(2) Refer to figure 3-7 and remove the air shroud.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, dents, breaks, and other damage. Replace a defective part.

(3) Inspect the mounting hardware for cracks, breaks, and damaged threads. Replace a damaged or missing part.

c. Installation.

(1) Refer to figure 3-7 and install the air shroud.

(2) Install the starter pulley (para 3-19).

3-21. Flywheel

a. Removal.

(1) Remove the air shroud (para 3-20).

(2) Refer to figure 3-8 and remove the flywheel.

b. Cleaning and Inspection.

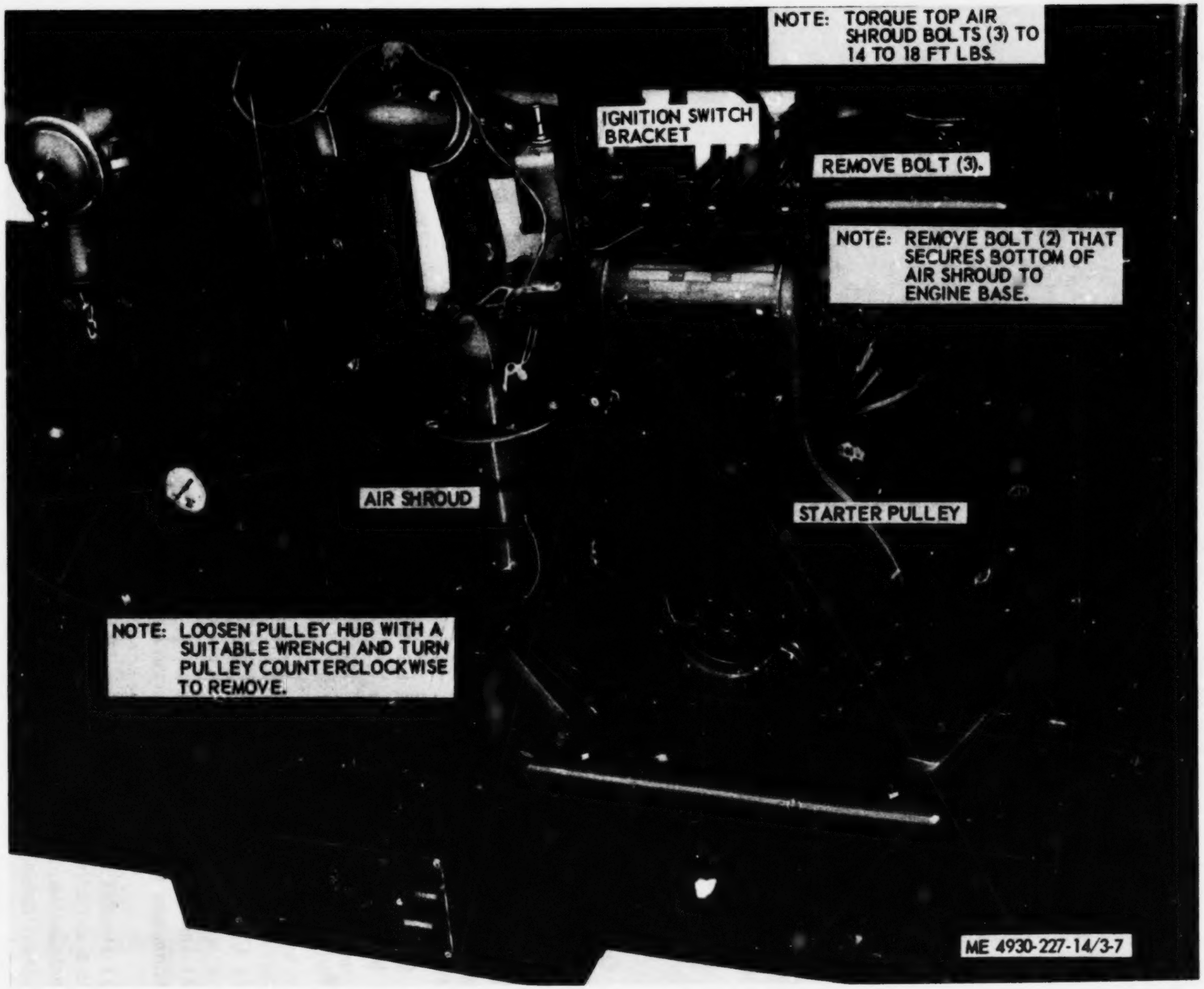
(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage. Replace a defective part.

c. Installation.

(1) Refer to figure 3-8 and install the flywheel.

(2) Install the air shroud (para 3-20).



IGNITION SWITCH BRACKET
AIR SHROUD
STARTER PULLEY
ME 4930-227-14/3-7

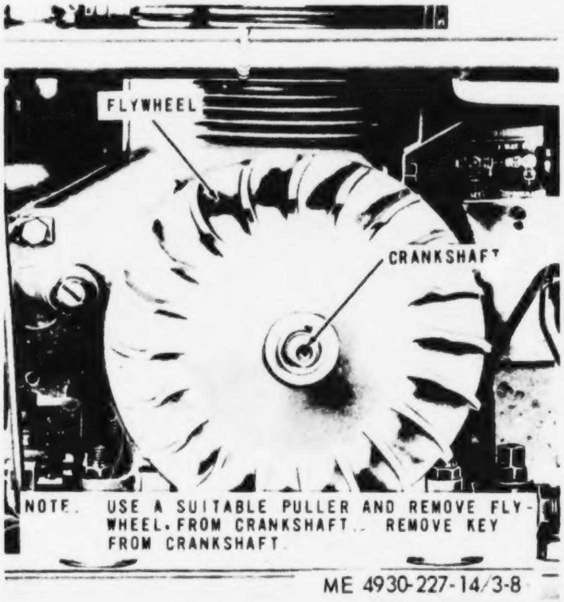
NOTE: TORQUE TOP AIR SHROUD BOLTS (3) TO 14 TO 18 FT LBS.

REMOVE BOLT (3).

NOTE: REMOVE BOLT (2) THAT SECURES BOTTOM OF AIR SHROUD TO ENGINE BASE.

NOTE: LOOSEN PULLEY HUB WITH A SUITABLE WRENCH AND TURN PULLEY COUNTERCLOCKWISE TO REMOVE.

Figure 3-7. Starter pulley, air shroud, and ignition switch bracket, removal and installation.



NOTE. USE A SUITABLE PULLER AND REMOVE FLYWHEEL FROM CRANKSHAFT. REMOVE KEY FROM CRANKSHAFT.

ME 4930-227-14/3-8

Figure 3–8. Flywheel, removal and installation.

Section IX. ENGINE IGNITION SYSTEM

3–22. General

The ignition system consists of the magneto, the spark plug, and the cable. All three parts are shielded to provide radio interference suppression. This section contains the maintenance instructions for the magneto, spark plug, and ignition cable.

3–23. Spark Plug, Ignition Cable, Ignition Switch, and Ground Cable

a. Removal. Refer to figure 3–9 and remove the ignition cable, ground cable, spark plug, and ignition switch.

b. Cleaning and Inspection.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect for cracks, breaks, signs of deterioration, and other damage. Replace a defective part.

(3) Inspect all threaded parts for damage. Replace a defective part.

c. Installation. Refer to figure 3–9 and install the ignition cable, spark plug, ignition switch, and ground cable.

3–24. Magneto

a. Removal.

(1) Refer to paragraph 3–20 and remove the air shroud.

(2) Refer to figure 3–10 and remove the magneto.

b. Disassembly. Refer to figure 3–11 and disassemble the magneto.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with a cloth dampened with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, wear, and other damage. Replace a defective or damaged part.

(3) Inspect the coil for frayed or deteriorated insulation. Replace a damaged or defective

(4) Inspect all hardware for stripped or damaged threads. Replace all damaged parts.

d. Reassembly. Refer to figure 3–11 and reassemble the magneto.

e. Magneto Breaker Points Replacement. Refer to figure 3–12 and replace the magneto points.

f. Magneto Drive Gear Replacement. Refer to figure 3–13 and remove and install the magneto drive gear.

g. Installation. Refer to figure 3–10 and install the magneto.

h. Timing the Magneto. Refer to figure 3–14 and time the magneto.

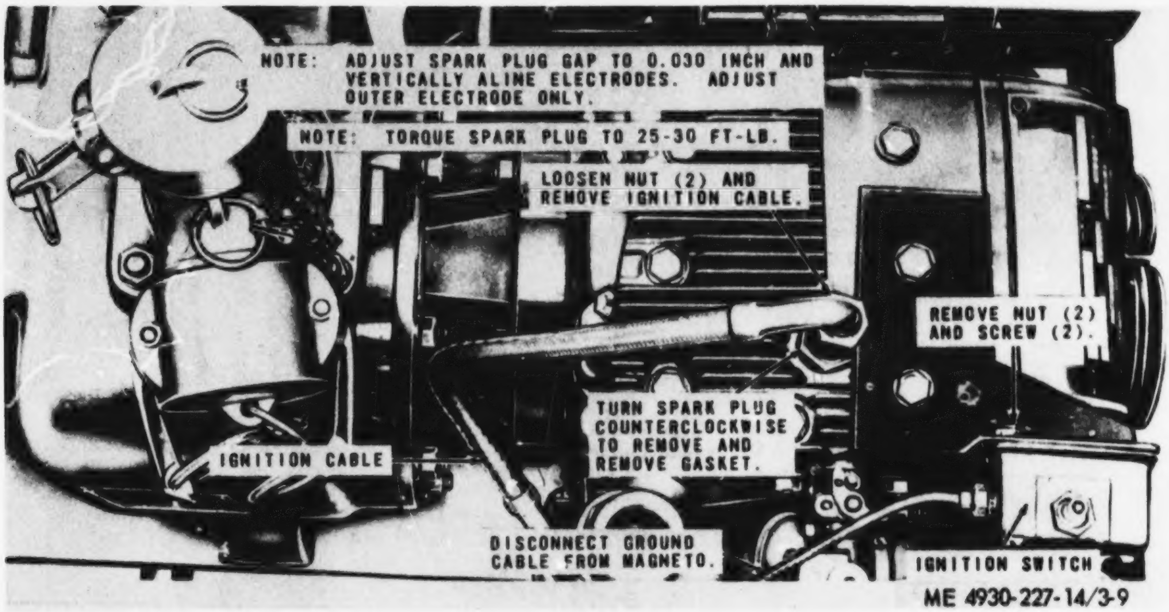

NOTE: ADJUST SPARK PLUG GAP TO 0.030 INCH AND VERTICALLY ALINE ELECTRODES. ADJUST OUTER ELECTRODE ONLY.
NOTE: TORQUE SPARK PLUG TO 25-30 FT-LB.
LOOSEN NUT (2) AND REMOVE IGNITION CABLE.
REMOVE NUT (2) AND SCREW (2).
TURN SPARK PLUG COUNTERCLOCKWISE TO REMOVE AND REMOVE GASKET.
IGNITION CABLE
DISCONNECT GROUND CABLE FROM MAGNETO.
IGNITION SWITCH
ME 4930-227-14/3-9

Figure 3–9. Spark plug, ignition cable, ignition switch, and ground cable, removal and installation.

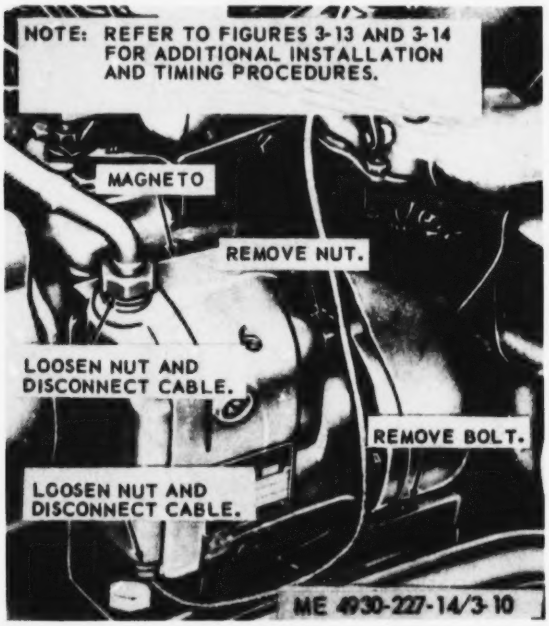
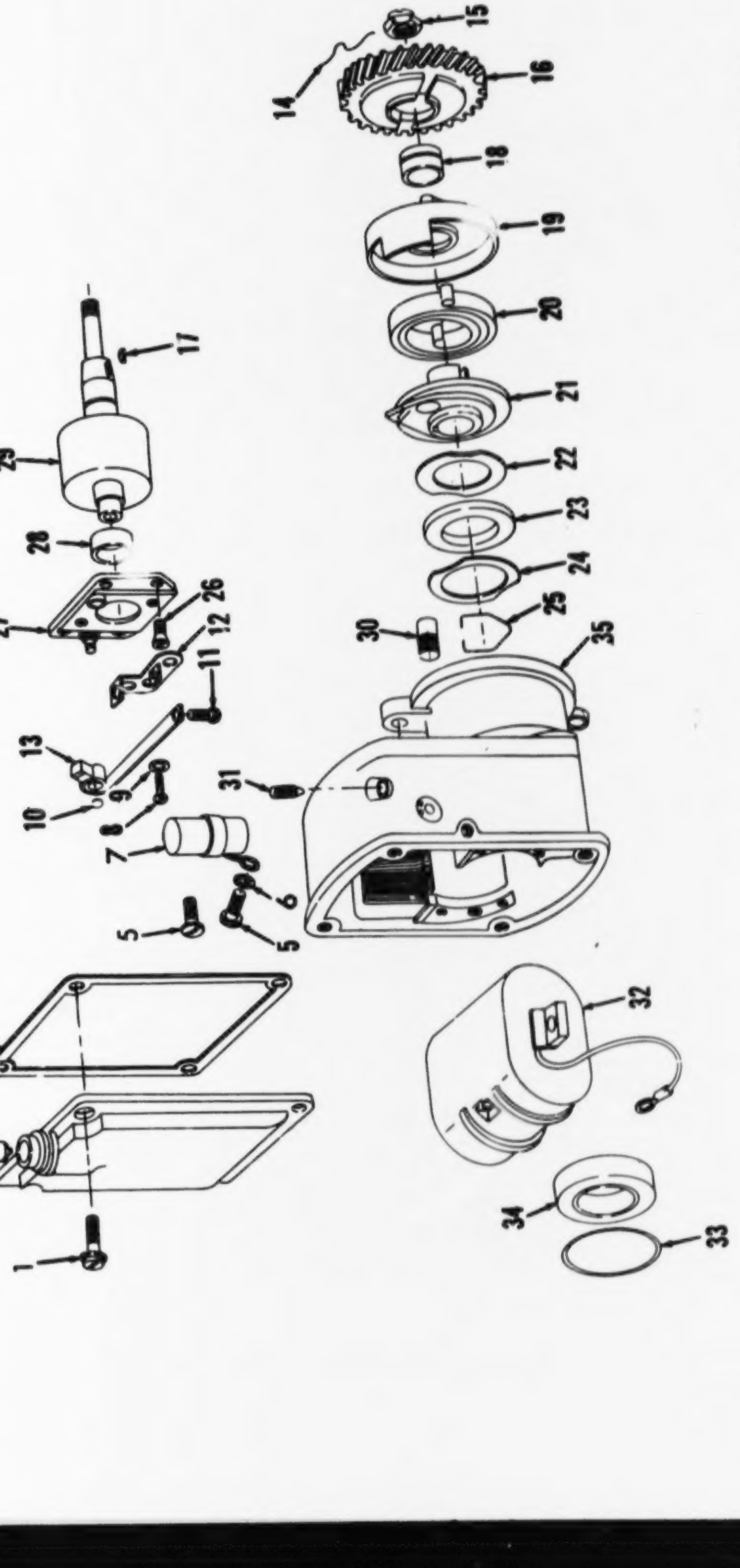

NOTE: REFER TO FIGURES 3-13 AND 3-14 FOR ADDITIONAL INSTALLATION AND TIMING PROCEDURES.
MAGNETO
REMOVE NUT.
LOOSEN NUT AND DISCONNECT CABLE.
REMOVE BOLT.
LOOSEN NUT AND DISCONNECT CABLE.
ME 4930-227-14/3-10

Figure 3–10. Magneto, removal and installation.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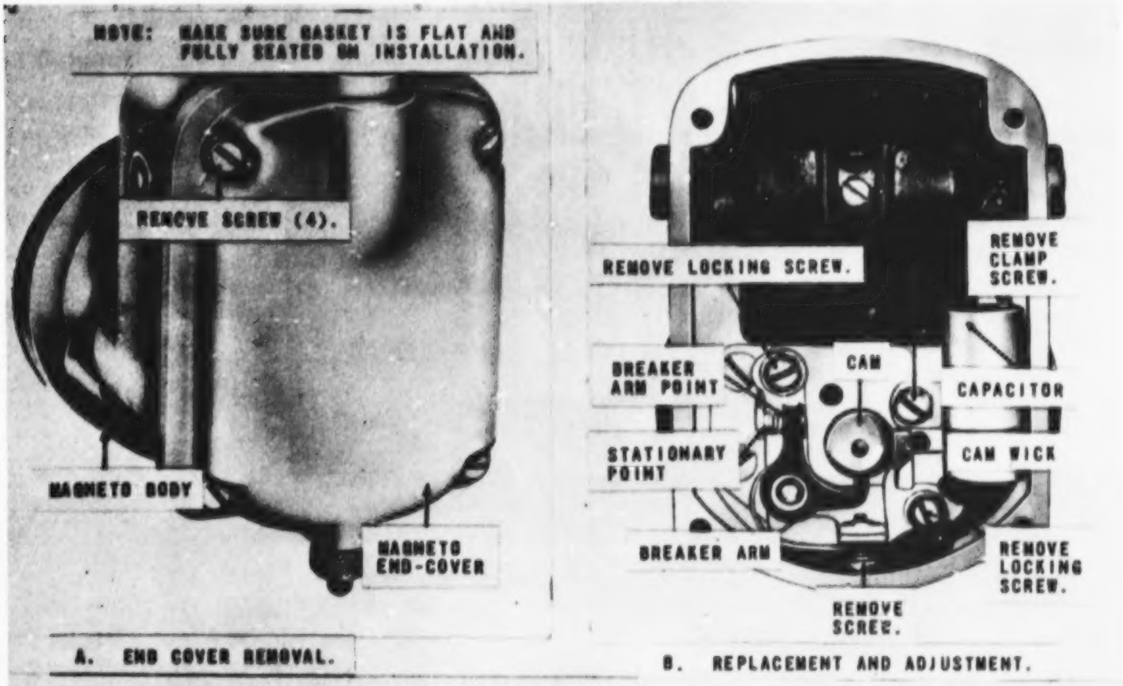
ME 4930-227-14/3-11

Figure 3-11. Magneto, disassembly and reassembly.


NOTE: MAKE SURE GASKET IS FLAT AND FULLY SEATED ON INSTALLATION.
REMOVE SCREW (4).
MAGNETO BODY
MAGNETO END-COVER
REMOVE LOCKING SCREW.
REMOVE CLAMP SCREW.
BREAKER ARM POINT
CAM
CAPACITOR
STATIONARY POINT
CAM WICK
BREAKER ARM
REMOVE LOCKING SCREW.
REMOVE SCREW.

A. END COVER REMOVAL.

B. REPLACEMENT AND ADJUSTMENT.

ADJUSTMENT:

STEP 1. MANUALLY TURN CAM SO THAT HIGHEST POINT CONTACTS THE BREAKER ARM.

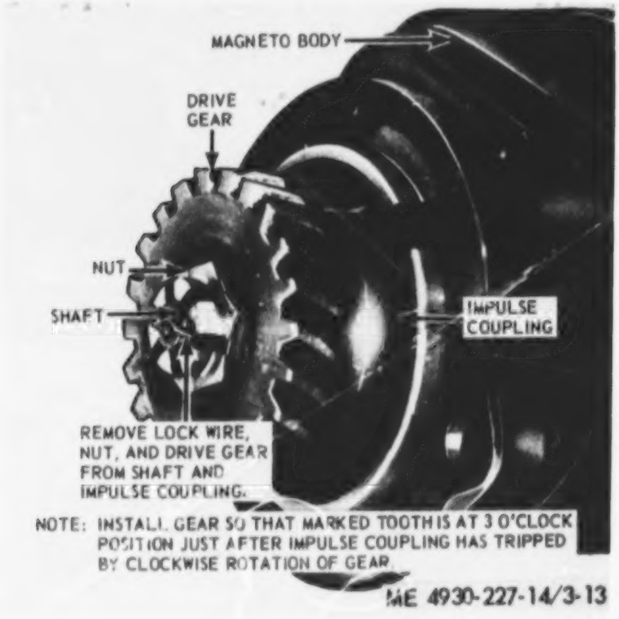
STEP 2. INSPECT CONTACT POINTS FOR ROUGHNESS AND FILE ROUGH SPOTS SMOOTH.

STEP 3. MEASURE GAP BETWEEN STATIONARY POINT AND BREAKER ARM POINT WITH A FEELER GAGE. GAP SHOULD MEASURE 0.015 INCH WITH CAM HIGH POINT AGAINST BREAKER ARM.

STEP 4. LOOSEN THE TWO LOCKING SCREWS AND ADJUST GAP TO 0.015 INCH IF NECESSARY. TIGHTEN LOCKING SCREWS.

ME 4930-227-14/3-12

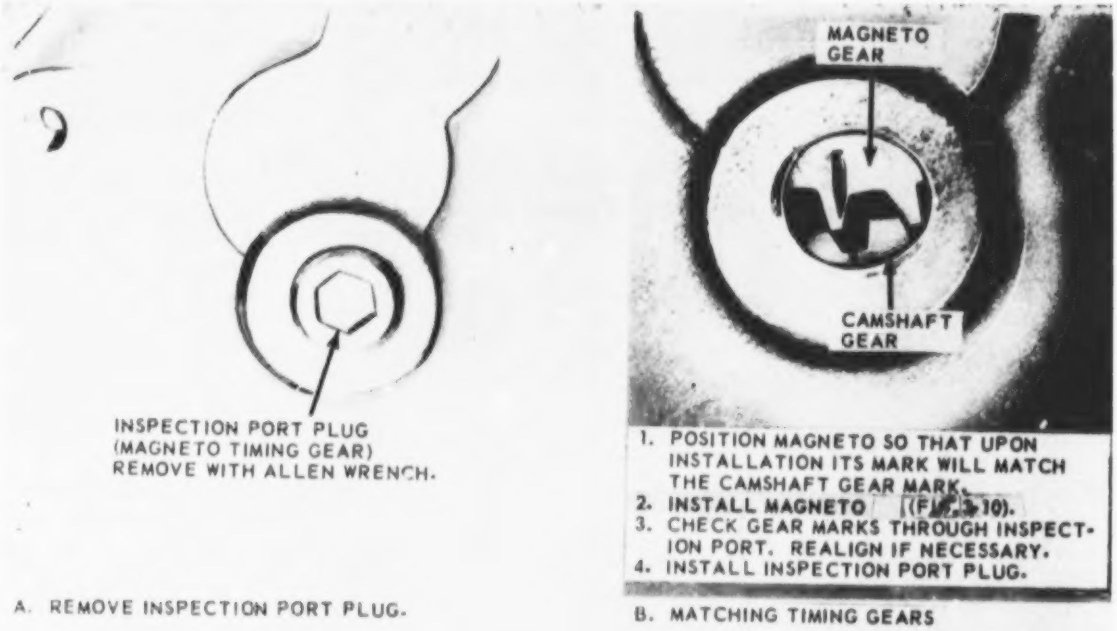
Figure 3-12. Magneto points replacement.


MAGNETO BODY
DRIVE GEAR
NUT
SHAFT
IMPULSE COUPLING
REMOVE LOCK WIRE, NUT, AND DRIVE GEAR FROM SHAFT AND IMPULSE COUPLING.

NOTE: INSTALL GEAR SO THAT MARKED TOOTH IS AT 3 O'CLOCK POSITION JUST AFTER IMPULSE COUPLING HAS TRIPPED BY CLOCKWISE ROTATION OF GEAR.

ME 4930-227-14/3-13

Figure 3-13. Magneto drive gear, removal and installation.


INSPECTION PORT PLUG (MAGNETO TIMING GEAR) REMOVE WITH ALLEN WRENCH.
MAGNETO GEAR
CAMSHAFT GEAR

1. POSITION MAGNETO SO THAT UPON INSTALLATION ITS MARK WILL MATCH THE CAMSHAFT GEAR MARK.
2. INSTALL MAGNETO (FIG. 3-10).
3. CHECK GEAR MARKS THROUGH INSPECTION PORT. REALIGN IF NECESSARY.
4. INSTALL INSPECTION PORT PLUG.

A. REMOVE INSPECTION PORT PLUG.

B. MATCHING TIMING GEARS

ME 4930-227-14/3-14

Figure 3-14. Timing the magneto.

Section X. ENGINE FUEL SYSTEM

3-25. General

The fuel system draws fuel by gravity flow from the fuel tank. Fuel flows through the fuel valve and fuel strainer and is delivered to the carburetor. An oil-bath type air filter is provided. This section contains the maintenance instructions for the fuel system.

3-26. Fuel Tank, Bracket, Fuel Strainer, and Shutoff Valve

a. Removal. Refer to figure 3-15 and remove the fuel strainer, shut-off valve, fuel tank, and bracket.

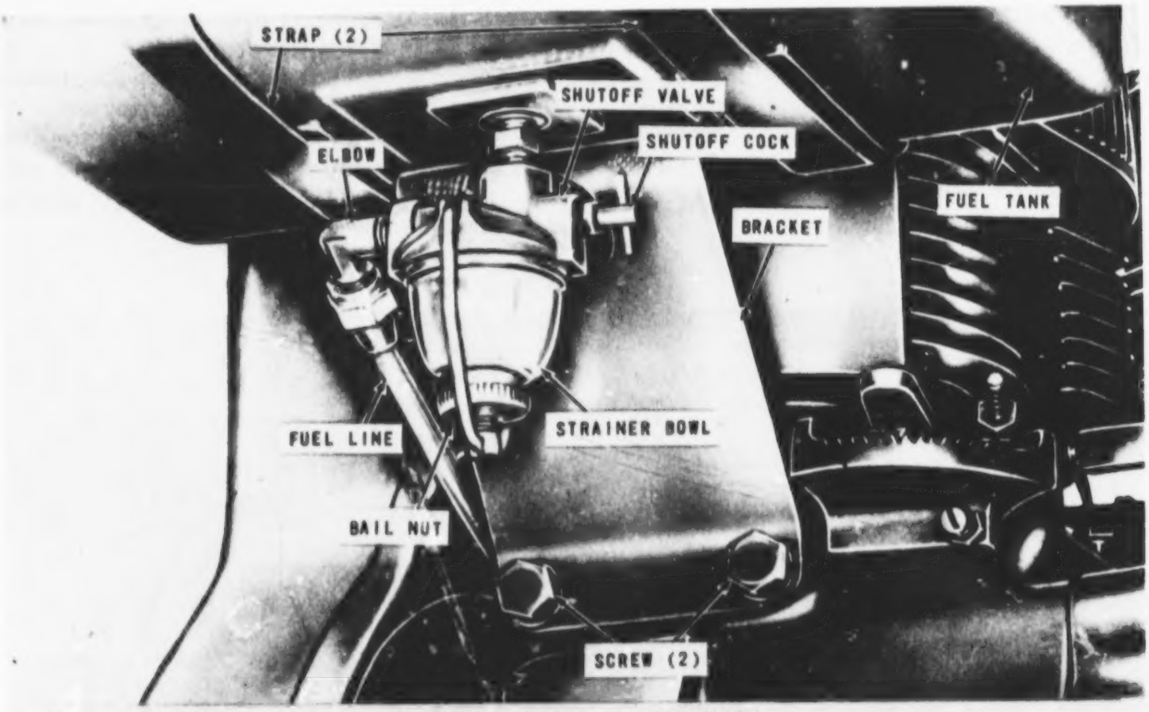
b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage. Replace a defective part.

(3) Inspect all threaded parts for damaged threads. Replace a defective part.

c. Installation. Refer to figure 3-15 and install the fuel strainer, shutoff valve, fuel tank, and bracket.



STEP 1. DRAIN FUEL TANK AND DISCONNECT FUEL LINE FROM ELBOW.
STEP 2. REMOVE SCREW (2) AND ONE CYLINDER HEAD BOLT, AND REMOVE THE FUEL TANK, BRACKET, FUEL STRAINER, AND SHUTOFF VALVE AS A UNIT.
STEP 3. LOOSEN BAIL NUT UNTIL BAIL SWINGS ASIDE, RELEASING THE STRAINER BOWL, AND REMOVE THE GASKET AND SCREEN FROM THE SHUTOFF VALVE.
STEP 4. REMOVE THE ELBOW AND SHUTOFF COCK AND TURN THE SHUTOFF VALVE COUNTERCLOCKWISE TO REMOVE IT FROM THE TANK.

NOTE: IF NECESSARY TO SEPARATE THE FUEL TANK FROM THE BRACKET, PRY THE STRAPS LOOSE AND SLIDE THEM OFF THE FUEL TANK.

NOTE: TO REMOVE FUEL STRAINER WITHOUT REMOVING THE FUEL TANK AND BRACKET, CLOSE SHUTOFF VALVE AND PERFORM STEP 3. ABOVE.

ME 4930-227-14/3-15

Figure 3-15. Fuel strainer, shutoff valve, fuel tank and bracket, removal and installation.

3-27. Air Cleaner and Bracket

a. Removal. Refer to figure 3-16 and remove the air cleaner, and bracket.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage. Replace a defective part.

(3) Inspect all threaded parts for damaged threads. Replace a damaged or missing part.

c. Installation. Refer to figure 3-16 and install the air cleaner and bracket.

3-28. Carburetor

a. Removal.

(1) Remove the air cleaner (para 3-27).

(2) Refer to figure 3-16 and remove the carburetor.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the carburetor for cracks, breaks, loose or missing screws, damaged bowl gasket, or other damage.

(3) Tighten or replace loose or missing gasket (*c* below). Replace a damaged or defective carburetor.

c. Service. Refer to figure 3-17 and service the carburetor.

d. Installation.

(1) Refer to figure 3-16 and install the carburetor.

(2) Install the air cleaner (para 3-27).

e. Adjustment. Refer to figure 3-18 and adjust the carburetor.

3-29. Governor Controls

a. Removal. Refer to figure 3-19 and remove the governor controls.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage. Replace a defective part.

(3) Inspect the mounting hardware for damaged threads. Replace a damaged or missing part.

c. Installation. Refer to figure 3-19 and install the governor controls.

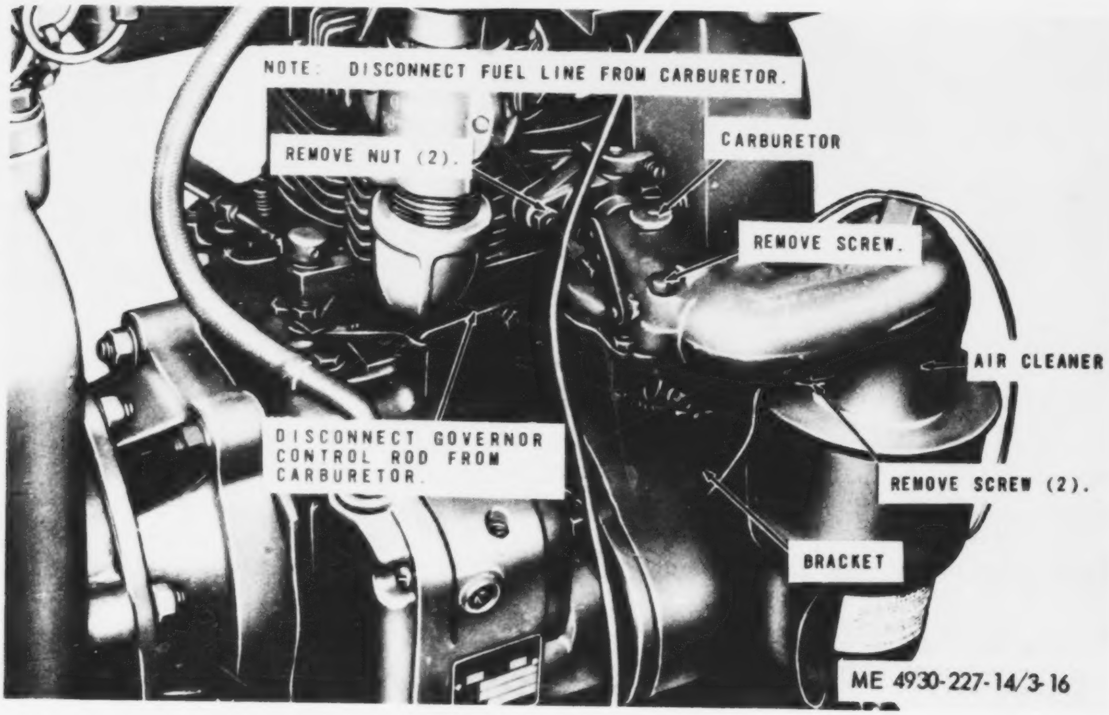
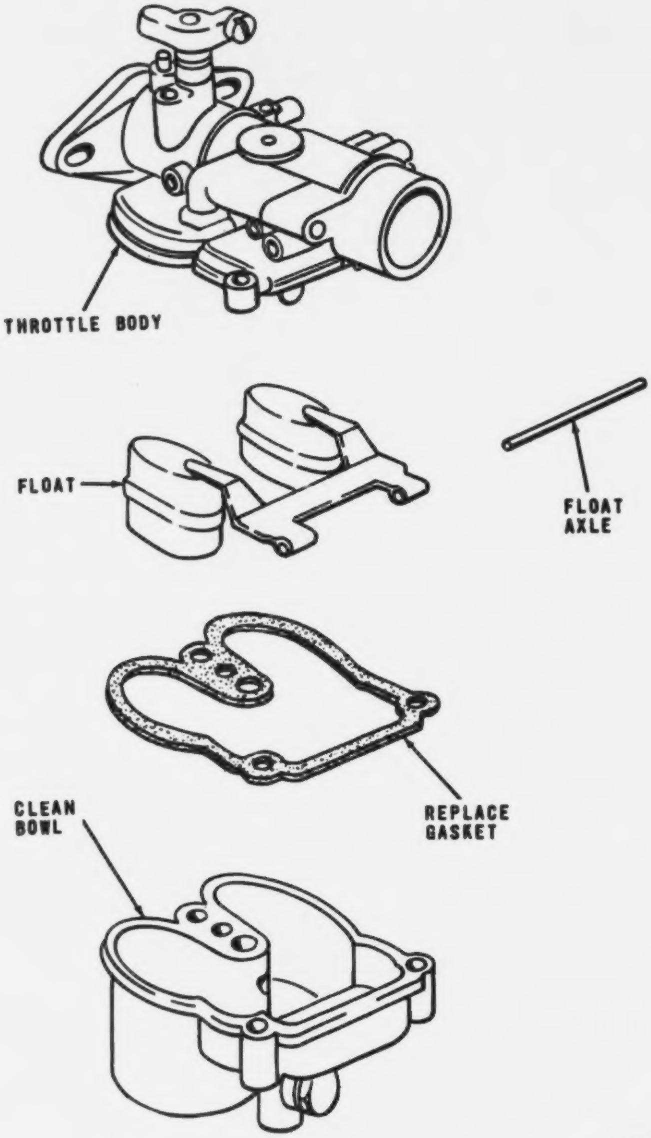
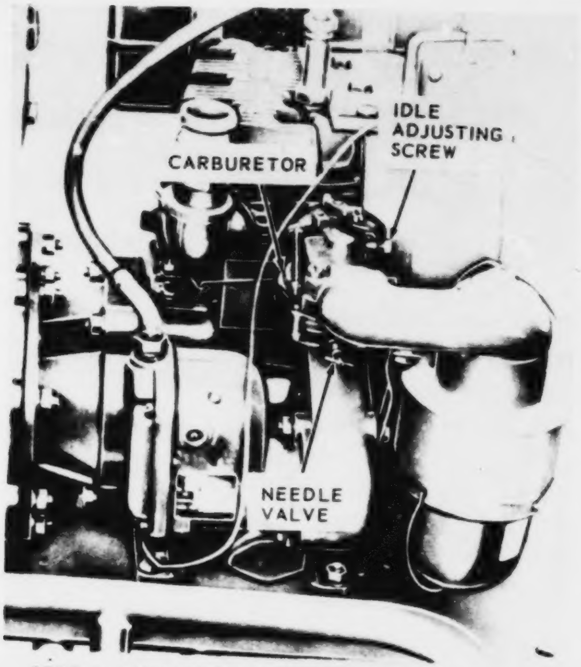

NOTE: DISCONNECT FUEL LINE FROM CARBURETOR.
REMOVE NUT (2).
CARBURETOR
REMOVE SCREW.
AIR CLEANER
DISCONNECT GOVERNOR CONTROL ROD FROM CARBURETOR.
REMOVE SCREW (2).
BRACKET
ME 4930-227-14/3-16

Figure 3-16. Air cleaner, bracket and carburetor, removal and installation.


THROTTLE BODY
FLOAT
FLOAT AXLE
CLEAN BOWL
REPLACE GASKET

ME 4930-227-14/3-17

Figure 3-17. Carburetor service.

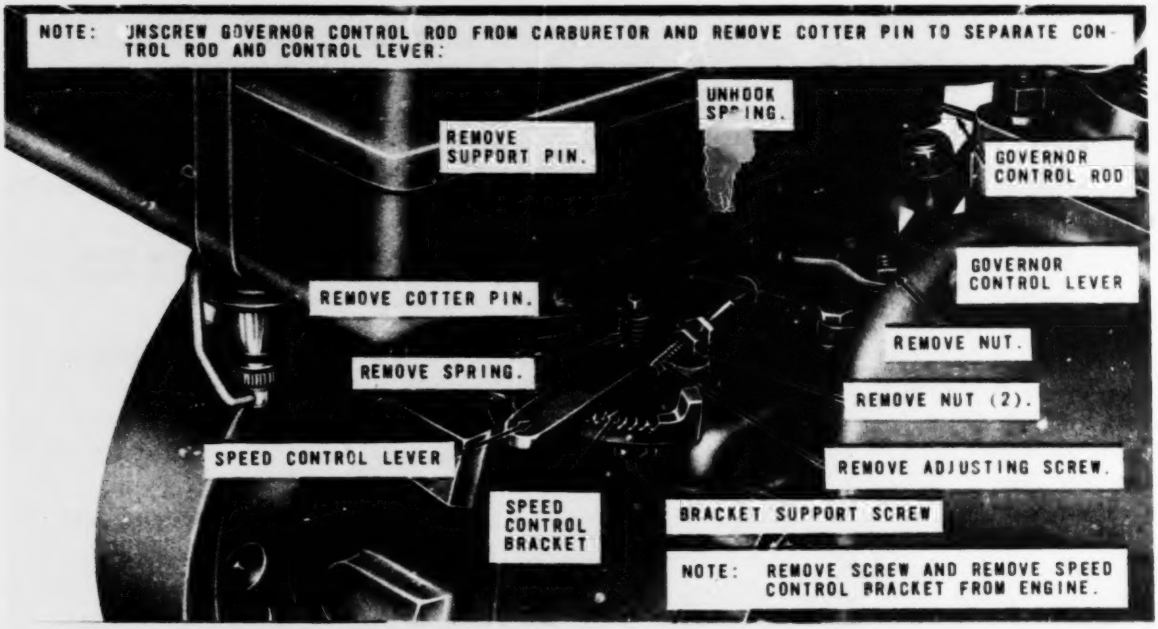


STEP 1. TURN NEEDLE VALVE FULLY CLOCKWISE TO CLOSE. DO NOT USE FORCE.
STEP 2. OPEN NEEDLE VALVE 1 TO 1 1/4 TURNS.
STEP 3. START ENGINE (PAR. 2-9).
STEP 4. ALLOW ENGINE TO WARM UP AND FULLY OPEN CHOKE.
STEP 5. ADJUST NEEDLE VALVE TO GIVE SMOOTHEST ENGINE PERFORMANCE.
STEP 6. TURN IDLE VALVE FULLY CLOCKWISE TO CLOSE.
STEP 7. OPEN IDLE VALVE 1/2 TO 3/4 TURNS AND ADJUST TO GIVE SMOOTHEST ENGINE IDLING.

CAUTION: USE OF FORCE IN CLOSING VALVES MAY DAMAGE VALVE SEATS.

ME 4930-227-14/3-18

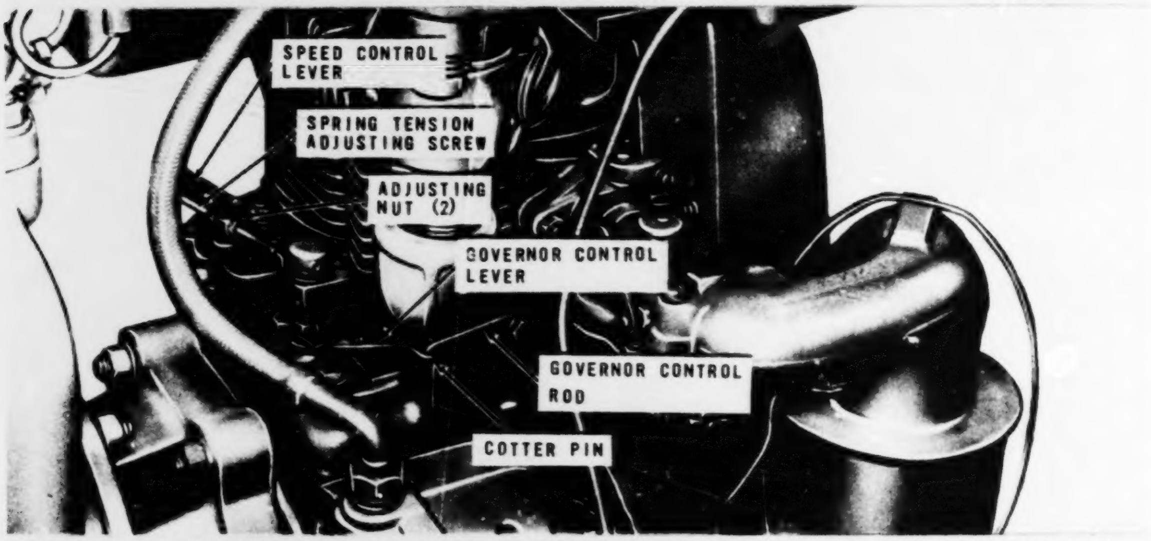
Figure 3–18. Carburetor adjustment.


UNHOOK SPRING.
REMOVE SUPPORT PIN.
GOVERNOR CONTROL ROD
GOVERNOR CONTROL LEVER
REMOVE COTTER PIN.
REMOVE NUT.
REMOVE SPRING.
REMOVE NUT (2).
SPEED CONTROL LEVER
REMOVE ADJUSTING SCREW.
SPEED CONTROL BRACKET
BRACKET SUPPORT SCREW

NOTE: UNSCREW GOVERNOR CONTROL ROD FROM CARBURETOR AND REMOVE COTTER PIN TO SEPARATE CONTROL ROD AND CONTROL LEVER.

NOTE: REMOVE SCREW AND REMOVE SPEED CONTROL BRACKET FROM ENGINE.

A. REMOVAL AND INSTALLATION.


SPEED CONTROL LEVER
SPRING TENSION ADJUSTING SCREW
ADJUSTING NUT (2)
GOVERNOR CONTROL LEVER
GOVERNOR CONTROL ROD
COTTER PIN

STEP 1. SET ENGINE SPEED BY ADJUSTING THE AMOUNT OF SPRING TENSION WITH THE ADJUSTING NUTS AND SCREW. TO INCREASE SPEED, INCREASE THE SPRING TENSION. DECREASE TENSION TO LOWER SPEED.

STEP 2. REMOVE COTTER PIN AND DISCONNECT GOVERNOR CONTROL ROD FROM CONTROL LEVER.

STEP 3. OPEN CARBURETOR THROTTLE WIDE AND MOVE SPEED CONTROL LEVER TO WIDE OPEN POSITION.

STEP 4. SCREW GOVERNOR CONTROL ROD IN OR OUT OF THE SWIVEL BLOCK ON THE CARBURETOR UNTIL THE BENT END OF THE ROD IS EXACTLY CENTERED OVER THE HOLE IN THE GOVERNOR CONTROL LEVER.

STEP 5. PLACE THE CONTROL ROD IN THE CONTROL LEVER AND SECURE WITH COTTER PIN.

B. ADJUSTMENT.

ME 4930-227-14/3-19

Figure 3-19. Governor controls, removal, installation and adjustment.

Section XI. EXHAUST MUFFLER AND ELBOW, FILL AND DRAIN PLUGS AND CRANKCASE BREATHER

3-30. General

This section contains the maintenance instructions for the muffler, fill and drain plugs and the crankcase breather.

3-31. Muffler

a. Removal. Refer to figure 3-4 and remove muffler.

Note. Remove wire from coupler before releasing.

b. Exhaust Elbow. Refer to figure 3-20 and remove exhaust elbow.

c. Disassembly. Refer to figure 3-21 and disassemble muffler.

d. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks and damaged threads. Replace a defective part.

e. Reassembly. Refer to figure 3-21 and reassemble muffler.

f. Installation.

(1) Refer to figure 3-20 and install the exhaust elbow.

(2) Refer to figure 3-4 and install muffler.

Note. When installing muffler, gasket set (7, fig. 3-21) must be installed in the following order. One copper, four asbestos and one copper gasket. Secure coupling half, quick disconnect levers, with wire.

3-32. Crankcase Breather, Fill and Drain Plugs

a. Removal. Refer to figure 3-20 and remove crankcase breather and fill and drain plugs.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks and damaged threads. Replace a defective part.

c. Installation. Refer to figure 3-20 and install crankcase breather and fill and drain plugs.

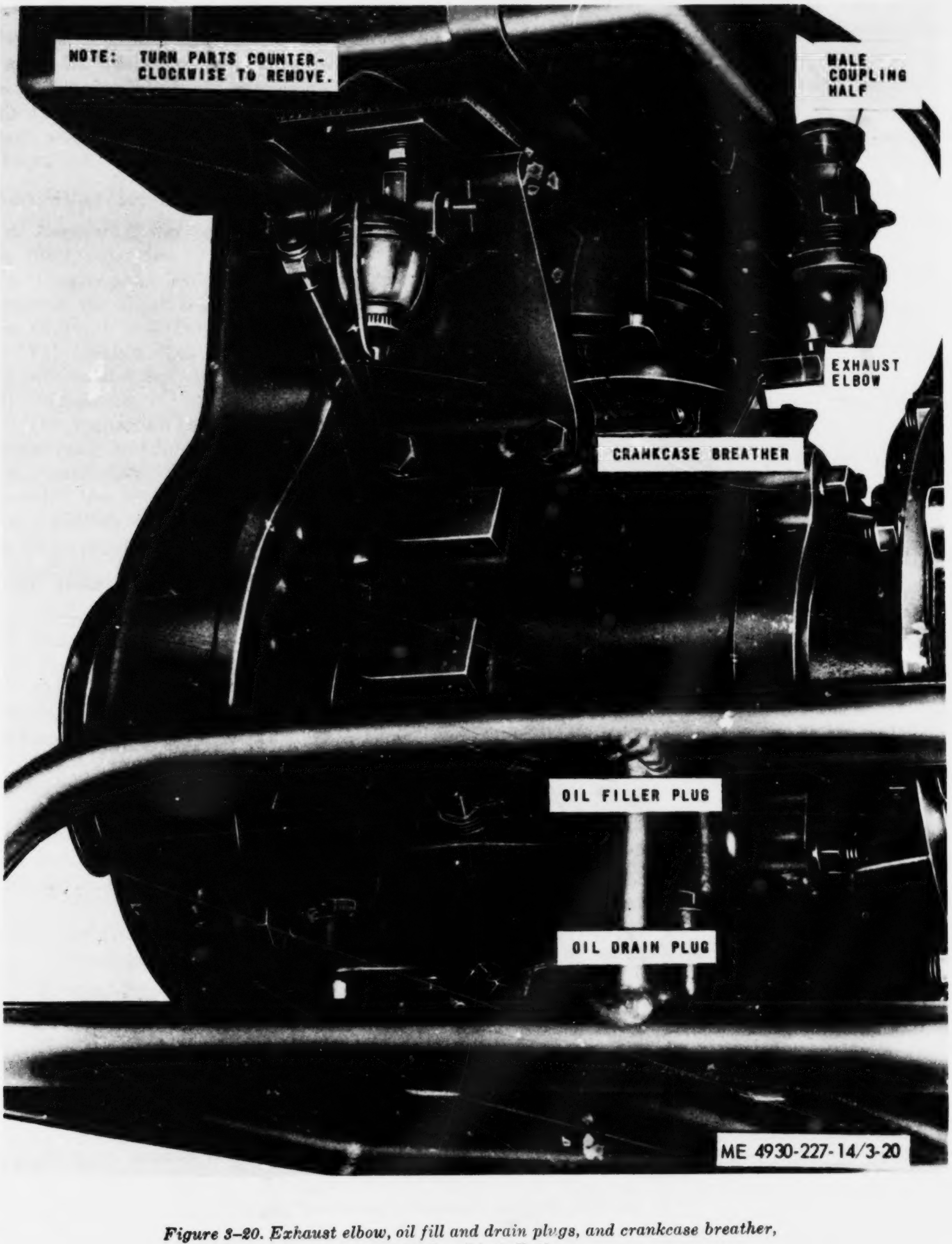
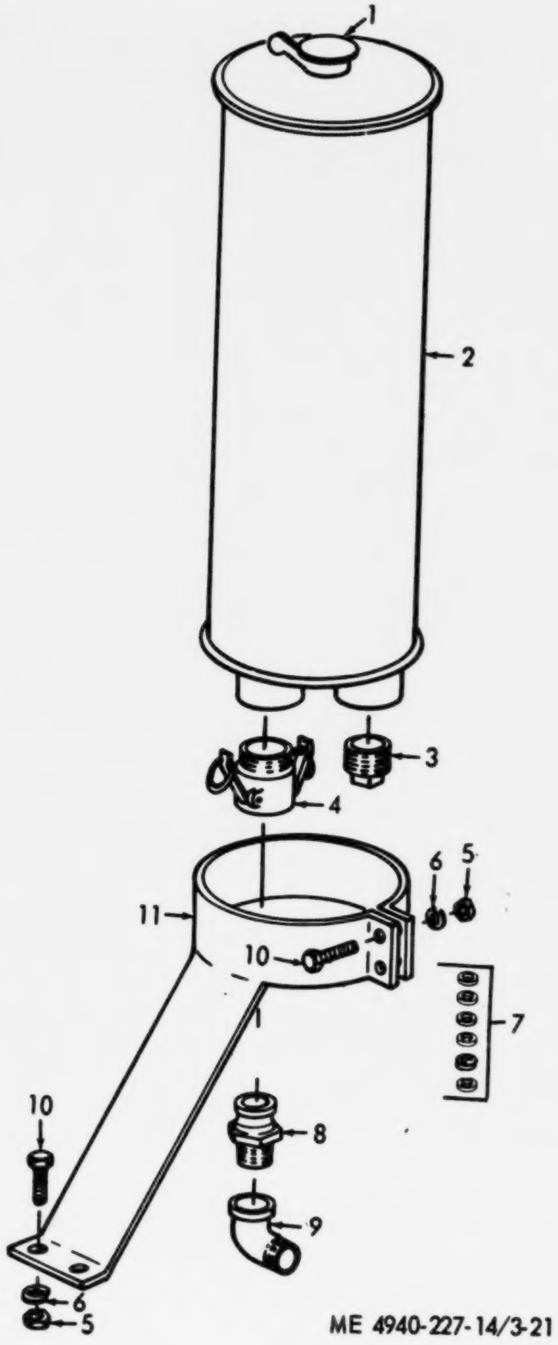

NOTE: TURN PARTS COUNTER-CLOCKWISE TO REMOVE.
MALE COUPLING HALF
EXHAUST ELBOW
CRANKCASE BREATHER
OIL FILLER PLUG
OIL DRAIN PLUG
ME 4930-227-14/3-20

Figure 3-20. Exhaust elbow, oil fill and drain plugs, and crankcase breather, removal and installation.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ME 4940-227-14/3-21

1 Cap
2 Muffler
3 Plug
4 Coupling half
5 Nut
6 Washer
7 Gasket set
8 Coupling half
9 Elbow
10 Screw
11 Bracket

Figure 3–21. Muffler, disassembly and reassembly.

Section XII. FILTER/SEPARATOR, HOSES AND REELS

3-33. General

The filter separator functions as a device for separating the solid contaminants from the product being dispensed. Refer to paragraph 1-4 for a detailed description of the filter/separator. The hoses and ground reels are also covered in this section.

3-34. Filter/Separator

a. Removal. Refer to figure 3-22 and remove the filter/separator.

b. Disassembly. Refer to figure 3-23 and disassemble the filter/separator.

c. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly. Flush interior of fliter/separator.

(2) Inspect all parts for cracks, breaks, damaged threads and defects. Replace a defective part.

d. Reassembly. Refer to figure 3-23 and reassemble the filter/separator.

e. Installation. Refer to figure 3-22 and install the filter/separator.

3-35. Hoses, Nozzles, and Bonding Wires

a. Removal. Refer to figure 3-24 and remove the hoses, nozzles, and bonding wires.

b. Cleaning, Inspection, and Repair.

(1) Clean metal parts with an approved cleaning solvent and dry thoroughly. Clean hose surface with a clean, dry, cloth.

(2) Inspect hoses for signs of deterioration and wear.

(3) Replace defective hoses, couplers, and adapters, as necessary.

c. Installation. Refer to figure 3-24 and install the hoses, nozzles, and bonding wires.

3-36. Hose Reels, Rollers, and Spring Housings

a. General. The two hose reels have a recoil tension spring to wind the 40-foot discharge hoses on the reels. The product enters each reel from the filter/separator through a pipe at the hub of the reel and is discharged through the hoses.

b. Removal.

(1) Remove discharge hoses and nozzles (para 3-35).

(2) Refer to figure 3-25 and remove the hose reels and spring housings.

***Warning:* Do not disassemble the spring housing assembly. The spring is under tension and can cause serious injury or even death if disassembled improperly. Repair of spring housing is by replacement only.**

(3) Refer to figure 3-26 and remove the hose rollers.

c. Disassembly. Refer to figure 3-27 and disassemble the hose reels.

d. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect for damage and defects and replace defective parts as necessary.

e. Reassembly. Refer to figure 3-27 and reassemble the hose reels.

f. Installation.

(1) Refer to figure 3-25 and install the hose reels and spring housings.

(2) Refer to figure 3-26 and install the hose rollers.

(3) Install hoses and nozzles (para 3-35).

3-37. Ground Reel

a. General. A ground reel (fig. 1-2) is attached to the frame of the pumping assembly to provide a means of electrically grounding the tank and pump unit. One section of the ground wire must be clipped to a ground connection near the tank and pump unit, before the other section is connected to the vehicle being fueled.

b. Removal. Refer to figure 3-28 and remove the ground reel and clips.

c. Disassembly. Refer to figure 3-29 and disassemble ground reel.

d. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect for cracks, breaks, and other damage.

(3) Replace a damaged or defective part.

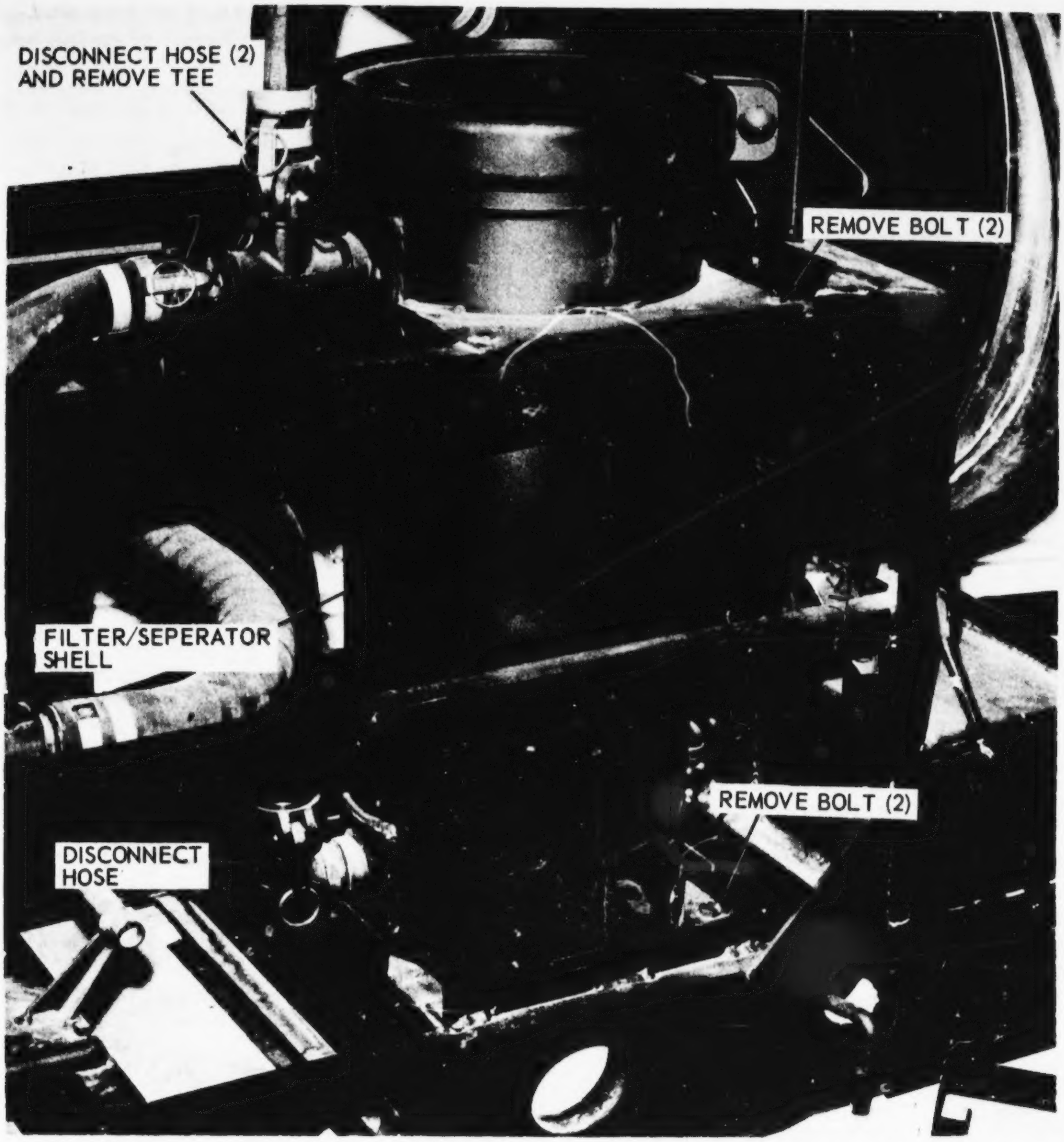
e. Reassembly. Refer to figure 3-29 and reassemble ground reel.

f. Installation. Refer to figure 3-28 and install ground reel.

3-38. Nozzle Assembly

a. Removal. Remove nozzle assembly (para 3-35).

b. Disassembly. Refer to figure 3-30 and disassemble nozzle assembly.


DISCONNECT HOSE (2) AND REMOVE TEE
REMOVE BOLT (2)
FILTER/SEPERATOR SHELL
REMOVE BOLT (2)
DISCONNECT HOSE

ME 4930-227-14/3-22

Figure 3-22. Filter/separator, removal and installation.

c. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

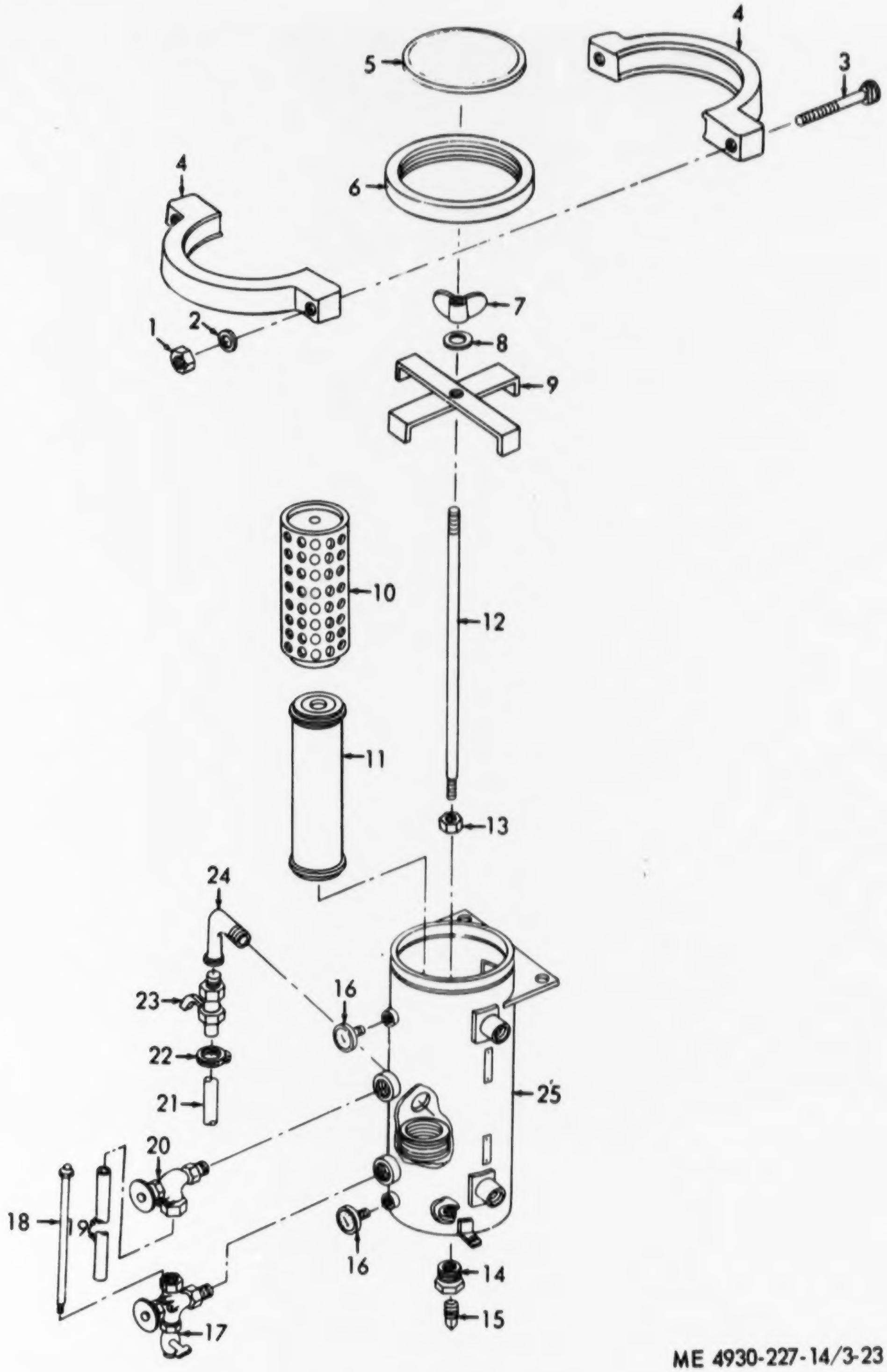
(2) Inspect for cracks, breaks, wear, and other damage.

(3) Replace damaged or defective parts.

d. Reassembly.

Refer to figure 3-30 and reassemble nozzle assembly.

e. Installation. Install nozzle assembly (para 3-35).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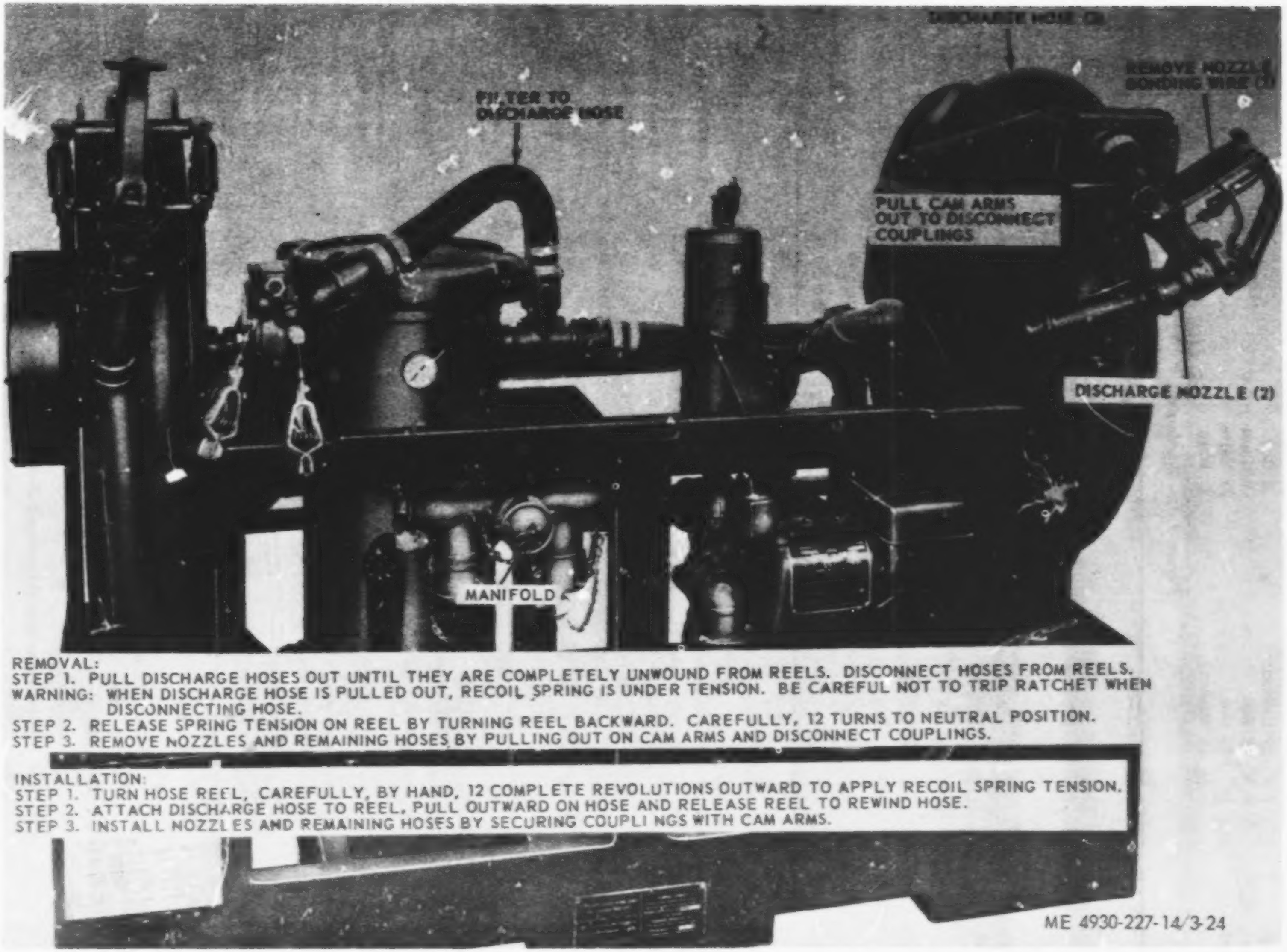
ME 4930-227-14/3-23

Figure 3-23. Filter/separator, disassembly and reassembly.

1 Nut
2 Washer
3 Bolt
4 Clamp
5 Cover
6 Gasket
7 Nut
8 Washer
9 Retainer
10 Canister
11 Element
12 Rod
13 Nut
14 Bushing
15 Plug
16 Gage
17 Valve
18 Rod
19 Glass
20 Valve
21 Hose
22 Clamp
23 Cock
24 Elbow
25 Filter

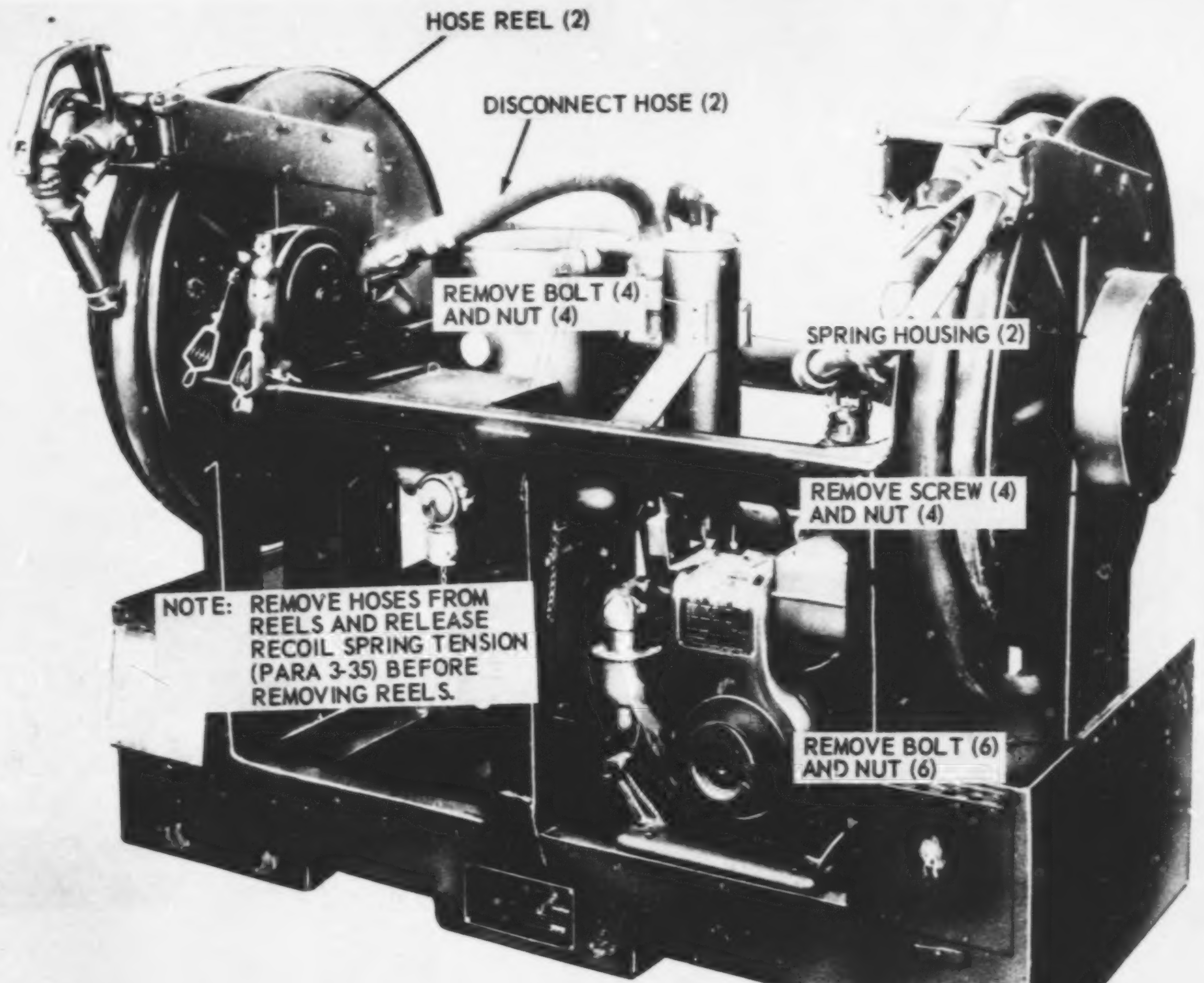
Figure 3-23—Continued.


DISCHARGE HOSE (2)
REMOVE NOZZLE BONDING WIRE (2)
FILTER TO DISCHARGE HOSE
PULL CAM ARMS OUT TO DISCONNECT COUPLINGS
DISCHARGE NOZZLE (2)
MANIFOLD
ME 4930-227-14/3-24

REMOVAL:
STEP 1. PULL DISCHARGE HOSES OUT UNTIL THEY ARE COMPLETELY UNWOUND FROM REELS. DISCONNECT HOSES FROM REELS.
WARNING: WHEN DISCHARGE HOSE IS PULLED OUT, RECOIL SPRING IS UNDER TENSION. BE CAREFUL NOT TO TRIP RATCHET WHEN DISCONNECTING HOSE.
STEP 2. RELEASE SPRING TENSION ON REEL BY TURNING REEL BACKWARD. CAREFULLY, 12 TURNS TO NEUTRAL POSITION.
STEP 3. REMOVE NOZZLES AND REMAINING HOSES BY PULLING OUT ON CAM ARMS AND DISCONNECT COUPLINGS.

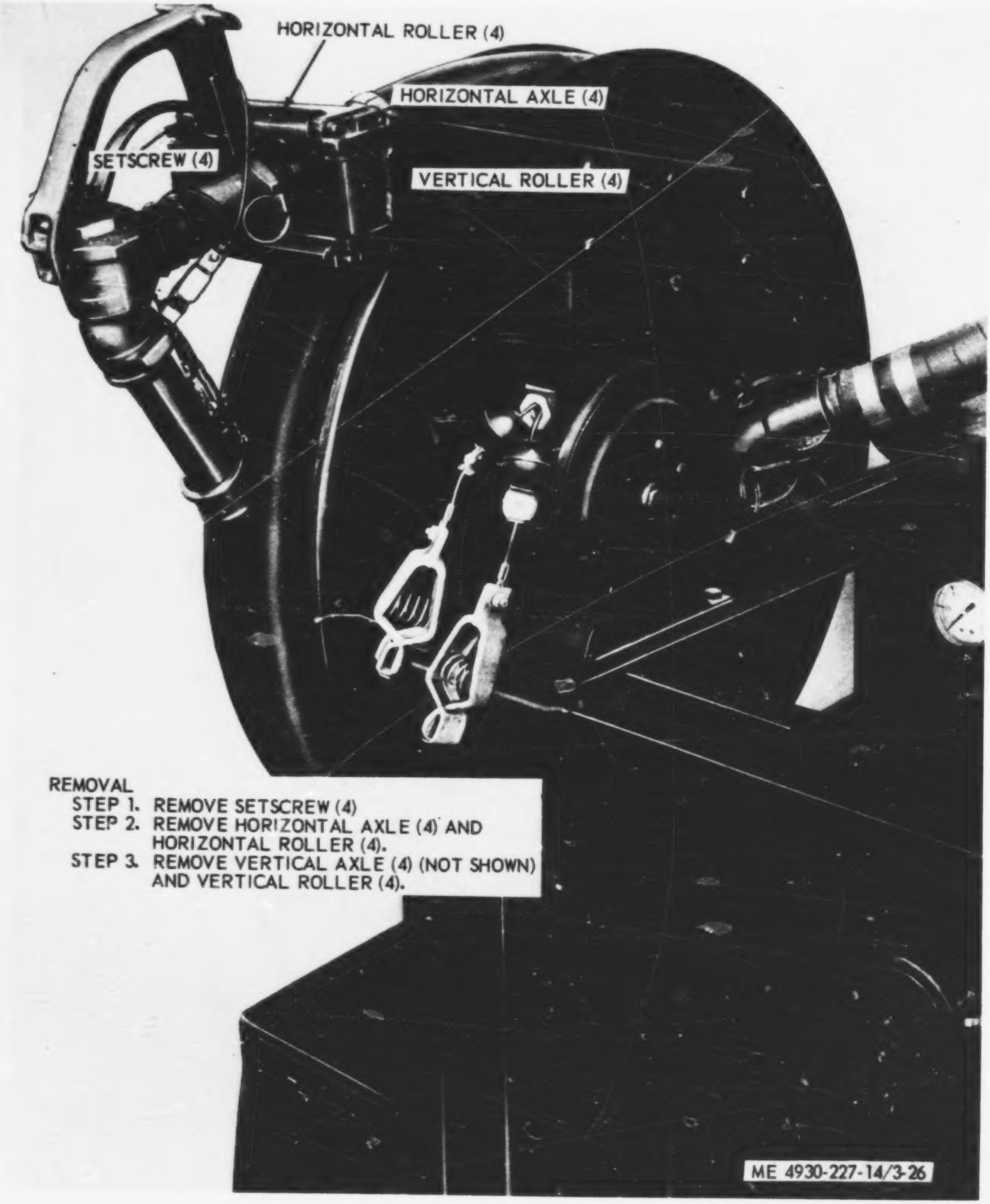
INSTALLATION:
STEP 1. TURN HOSE REEL, CAREFULLY, BY HAND, 12 COMPLETE REVOLUTIONS OUTWARD TO APPLY RECOIL SPRING TENSION.
STEP 2. ATTACH DISCHARGE HOSE TO REEL, PULL OUTWARD ON HOSE AND RELEASE REEL TO REWIND HOSE.
STEP 3. INSTALL NOZZLES AND REMAINING HOSES BY SECURING COUPLINGS WITH CAM ARMS.

Figure 3-24. Hoses, nozzles and bonding wires, removal and installation.


HOSE REEL (2)
DISCONNECT HOSE (2)
REMOVE BOLT (4) AND NUT (4)
SPRING HOUSING (2)
REMOVE SCREW (4) AND NUT (4)
NOTE: REMOVE HOSES FROM REELS AND RELEASE RECOIL SPRING TENSION (PARA 3-35) BEFORE REMOVING REELS.
REMOVE BOLT (6) AND NUT (6)

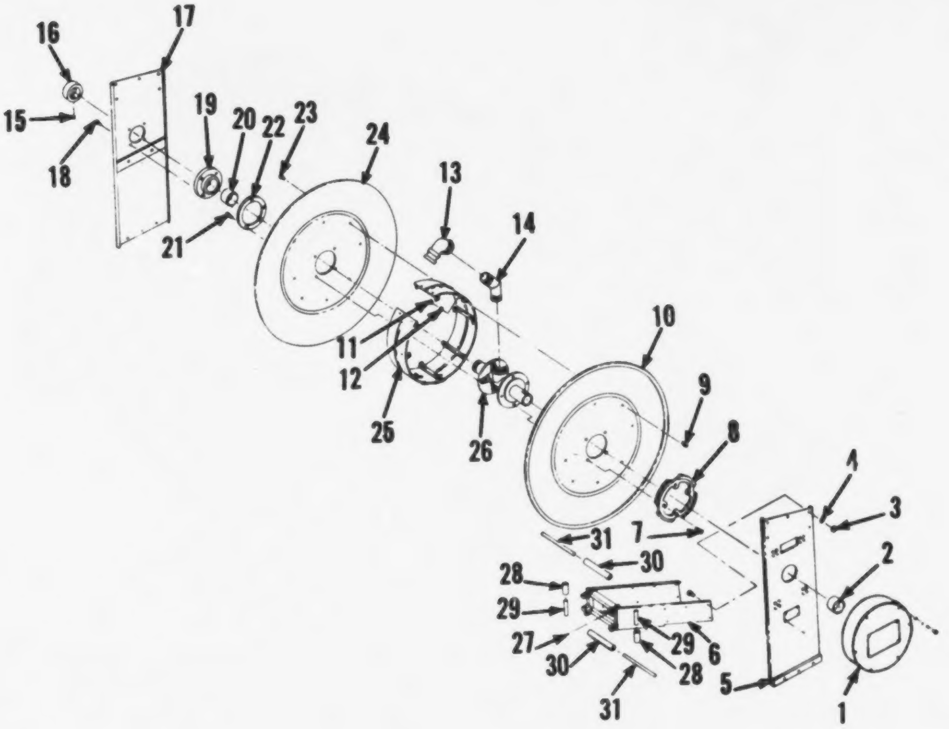
ME 4930-227-14/3-25

Figure 3-25. Hose reels and spring housings assembly, removal and installation.


HORIZONTAL ROLLER (4)
HORIZONTAL AXLE (4)
SETSCREW (4)
VERTICAL ROLLER (4)
ME 4930-227-14/3-26

REMOVAL
STEP 1. REMOVE SETSCREW (4)
STEP 2. REMOVE HORIZONTAL AXLE (4) AND HORIZONTAL ROLLER (4).
STEP 3. REMOVE VERTICAL AXLE (4) (NOT SHOWN) AND VERTICAL ROLLER (4).

Figure 3-26. Hose rollers, removal and installation.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ME 4930-227-14/3-27

Figure 3-27. Hose reels, disassembly and reassembly.

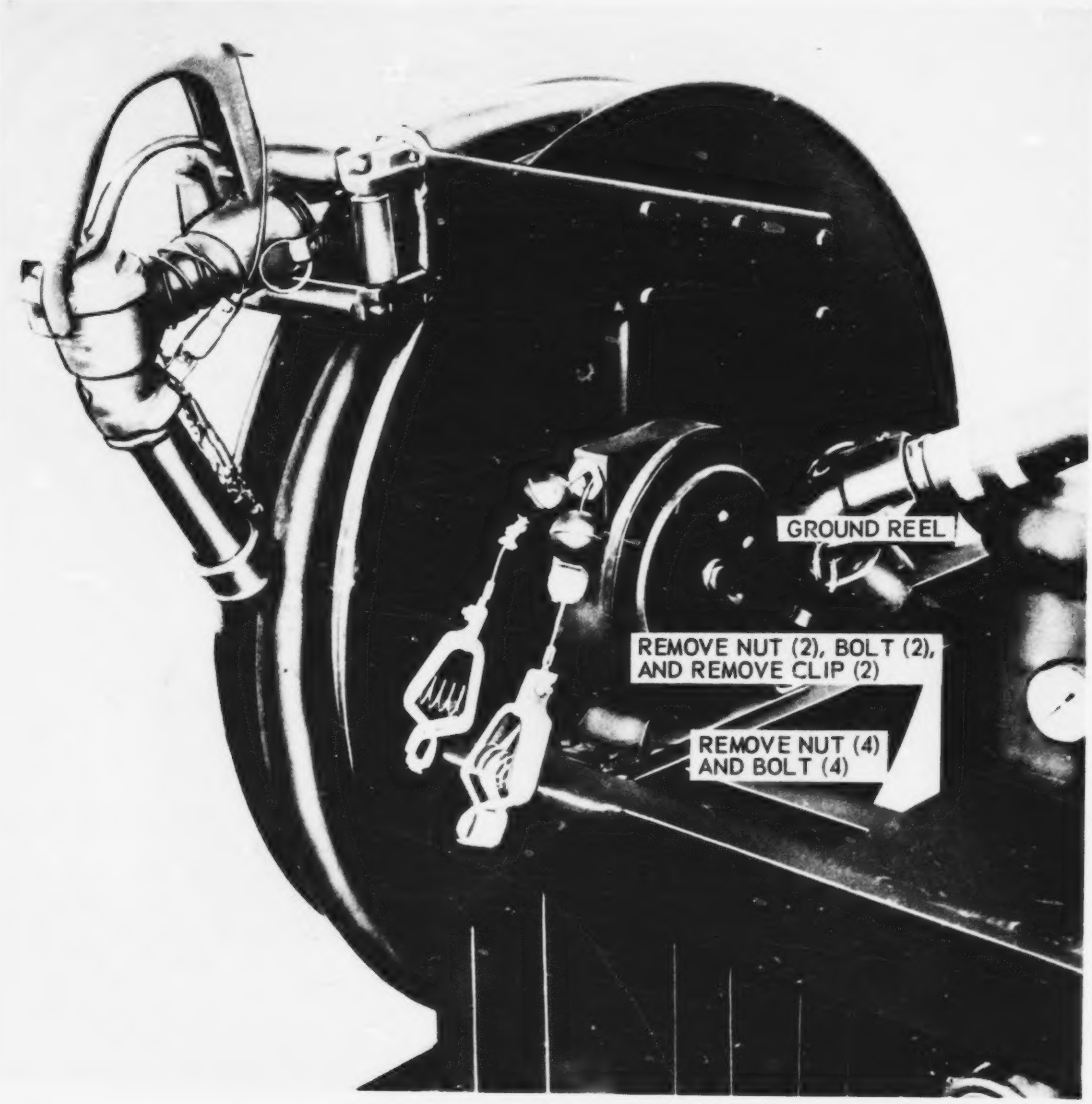
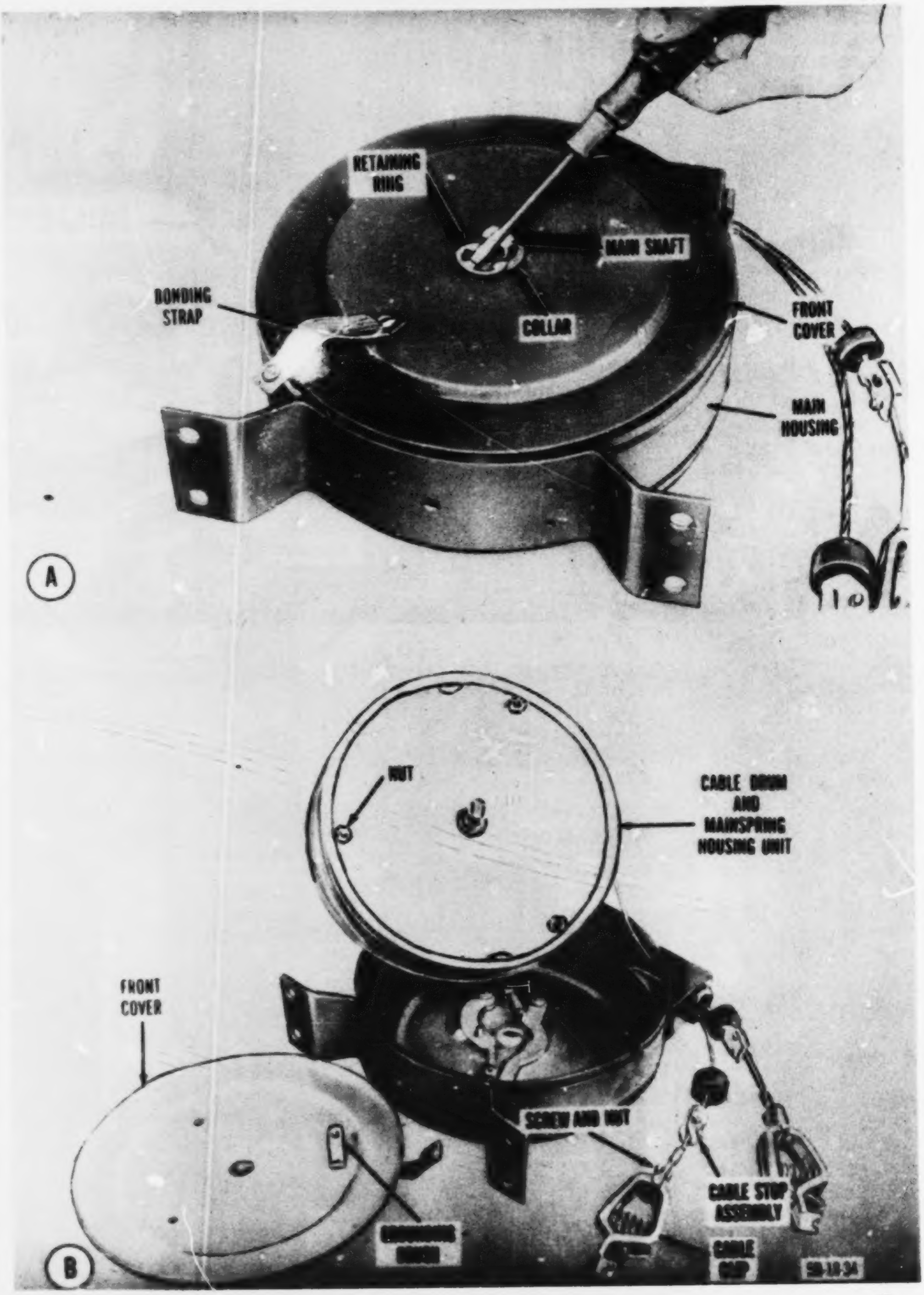
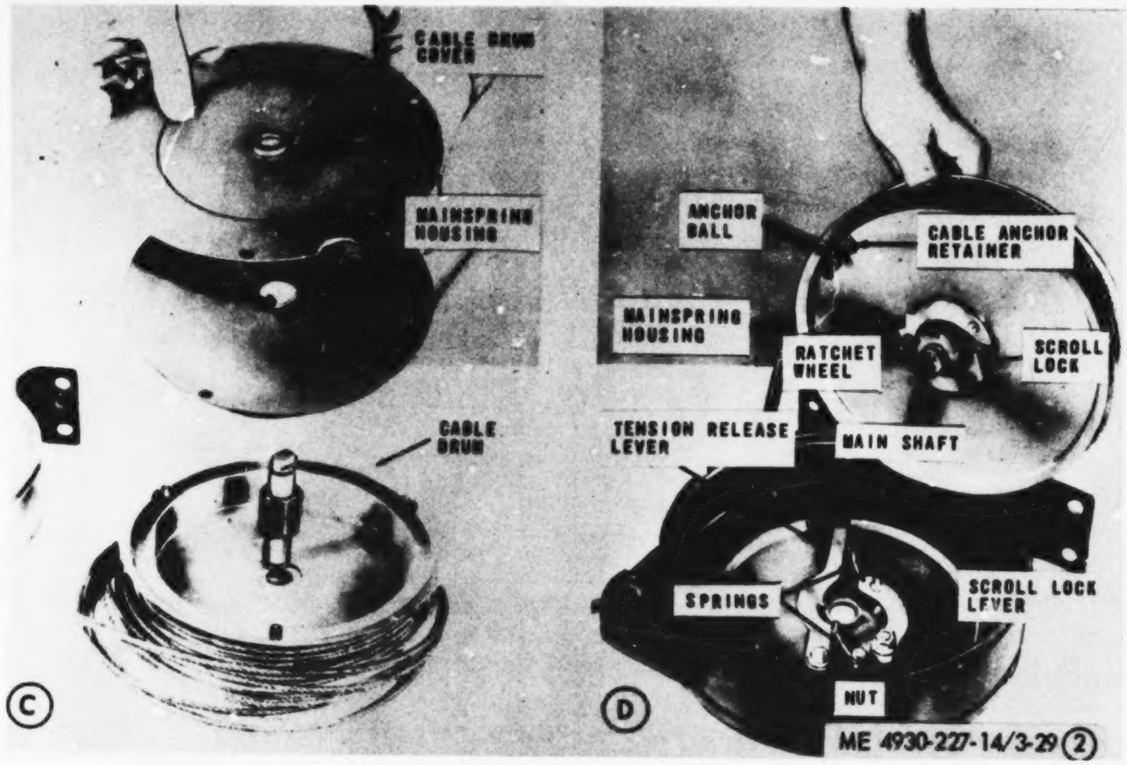

GROUND REEL
REMOVE NUT (2), BOLT (2), AND REMOVE CLIP (2)
REMOVE NUT (4) AND BOLT (4)
ME 4930-227-14/3-28

Figure 3-28. Ground reel and clips, removal and installation.


RETAINING RING
MAIN SHAFT
BONDING STRAP
COLLAR
FRONT COVER
MAIN HOUSING
A
NUT
CABLE DRUM AND MAINSPRING HOUSING UNIT
FRONT COVER
SCREW AND NUT
CABLE STOP ASSEMBLY
CABLE CLIP
B

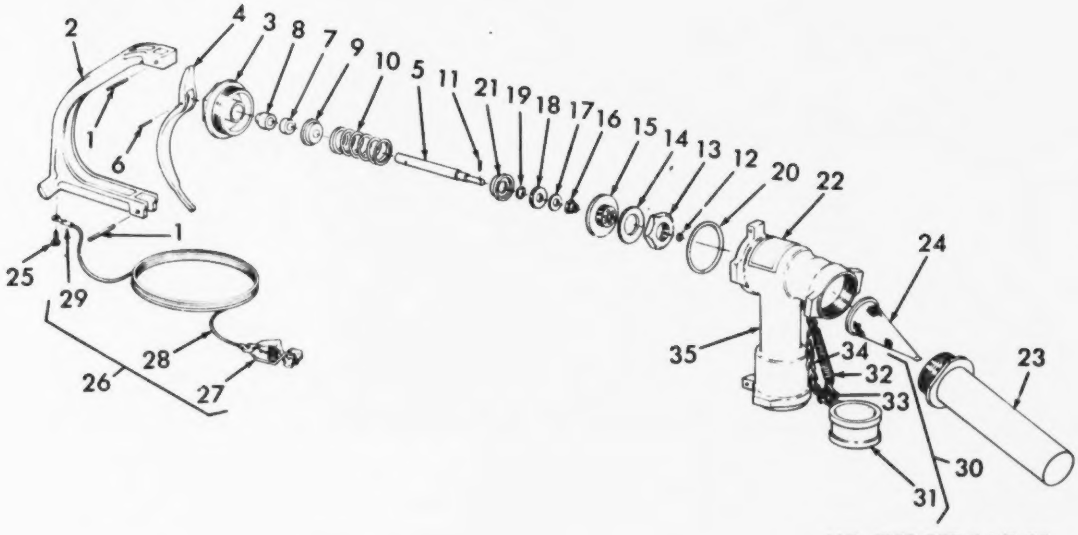
ME 4930-227-14/3-29 ①

Figure 3-29 (1). Ground reel, disassembly and reassembly.


CABLE DRUM COVER
MAINSPRING HOUSING
CABLE DRUM
C
ANCHOR BALL
CABLE ANCHOR RETAINER
MAINSPRING HOUSING
RATCHET WHEEL
SCROLL LOCK
TENSION RELEASE LEVER
MAIN SHAFT
SPRINGS
SCROLL LOCK LEVER
NUT
D

ME 4930-227-14/3-29 ②

Figure 3-29 (2)—Continued.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ME 4930-227-14/3-30

Figure 3-30. Nozzle assembly, disassembly and reassembly.

1 Pin (2)
2 Guard
3 Cap
4 Lever
5 Stem
6 Pin
7 Packing gland
8 Packing
9 Retainer
10 Spring
11 Pin
12 Washer
13 Nut
14 Valve body
15 Valve disc
16 Nut
17 Washer
18 Valve disc
19 O-ring
20 O-ring
21 Valve body
22 Name plate
23 Tube assembly
24 Strainer assembly
25 Screw
26 Ground cable assembly
27 Clip
28 Cable
29 Eyelet
30 Dust cap assembly
31 Dust cap
32 Spring
33 Hook (2)
34 Chain
35 Body

Figure 3-30—Continued.

Section XIII. Manifold

3-39. General

The manifold controls the flow of the product to the suction side of the pump. Two quick couplers provide connections or inlets for the tank suction lines. Flow of the product from either or both tanks is conducted to the pump suction through the manifold outlet and a suction hose.

3-40. Manifold

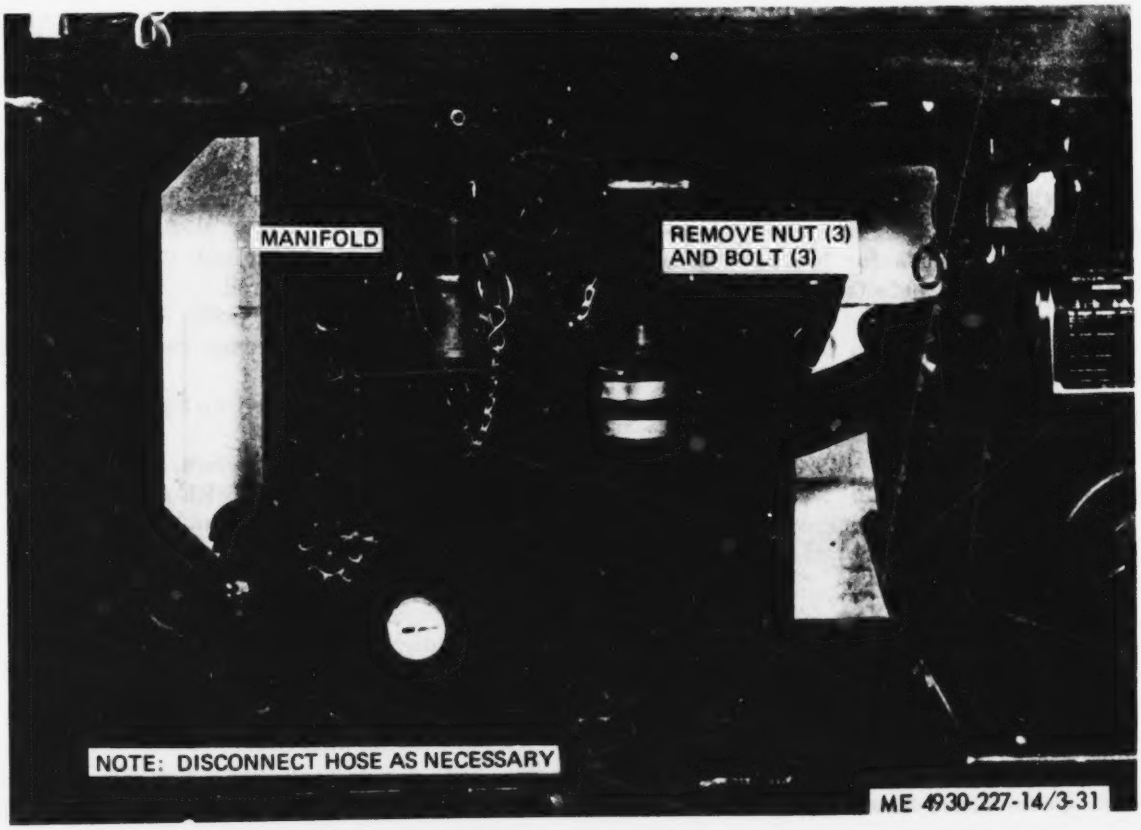
a. Removal. Refer to figure 3-31 and remove the manifold.

b. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for breaks, cracks, and damaged threads. Replace a defective part.

c. Installation. Refer to figure 3-31 and install manifold.



NOTE: DISCONNECT HOSE AS NECESSARY

Figure 3-31. Manifold, removal and installation.

Section XIV. TANKS AND COMPONENTS

3-41. Cleaning Tanks and Components

a. General. The tank and tank components must be cleaned before any repair is initiated. Each time a major component is removed for repair, inspection or other service, all parts must be thoroughly cleaned. Clean the discharge valve each time the tank is drained. Clean the tank interior and exterior prior to repair.

b. Components. Clean metal parts with cleaning solvent, Federal Specification P-S-661. Immerse each part in solvent and remove contaminants by brushing. Allow parts to dry thoroughly. Coat parts with a thin film of light lubricating oil or perservative oil before assembly.

3-42. Manhole Assembly

a. Vent Assembly. The manhole assembly ((7) fig. 3-32) is provided with a vent assembly located in the cover (6).

b. Removal.

(1) Refer to figure 3-33, release cam (7) and raise hing (15).

(2) Open manhole cover (10) and loosen the six nuts (2) so that hooks (4) will drop free of tank rim.

(3) Lift manhole cover from tank.

c. Disassembly. Refer to figure 3-33 and disassemble manhole cover.

d. Cleaning and Inspection.

(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect parts for breaks, cracks, damaged threads and defects. Replace a defective part.

e. Reassembly. Refer to figure 3-33 and reassemble the manhole cover.

f. Installation.

(1) Replace manhole cover on tank.

(2) Position hooks (4) on tank rim and tighten nuts (2).

(3) Close cover (10), drop hinge (15) into position and lock cam (7).

3-43. Pump Port

a. General. A pump port cover assembly ((10 fig. 3-32) is provided so that a hand pump may be used.

b. Service. Remove pump port cover and examine gasket. Replace if defective.

3-44. Drain Valve Assembly

a. General. A drain valve assembly is provided for draining the tanks.

b. Draining Tank.

(1) Refer to figure 3-32 and turn handle (9) counterclockwise to drain tank.

(2) Turn handle clockwise to close drain.

c. Removal.

(1) Remove manhole cover (para 3-42).

(2) Insure that tank has been completely drained.

(3) Enter tank through manhole opening.

(4) Refer to figure 3-34 and loosen setscrew (5).

d. Disassembly. Refer to figure 3-34 and disassemble drain valve.

e. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for breaks, cracks, and damaged threads. Replace a damaged part.

f. Reassembly. Refer to figure 3-34 and reassemble drain valve.

g. Installation.

(1) Tighten setscrew (5).

(2) Replace manhole cover (para 3-42).

3-45. Discharge Valve Assembly

a. Removal.

(1) Remove manhole cover (para 3-42).

(2) Pull control lever ((5) fig. 3-32) to close position and remove dust cap (17).

(3) Enter tank thru manhole opening.

(4) Refer to figure 3-35, loosen adjusting bale (6), disengage lift rod (7) from adjusting bale and remove lift rod.

(5) Outside the tank, remove six nuts (24) holding valve to sump ring (8) and remove valve assembly.

b. Disassembly. Refer to figure 3-35 and disassemble valve.

c. Cleaning and Inspection.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, or other damage. Replace a defective part.

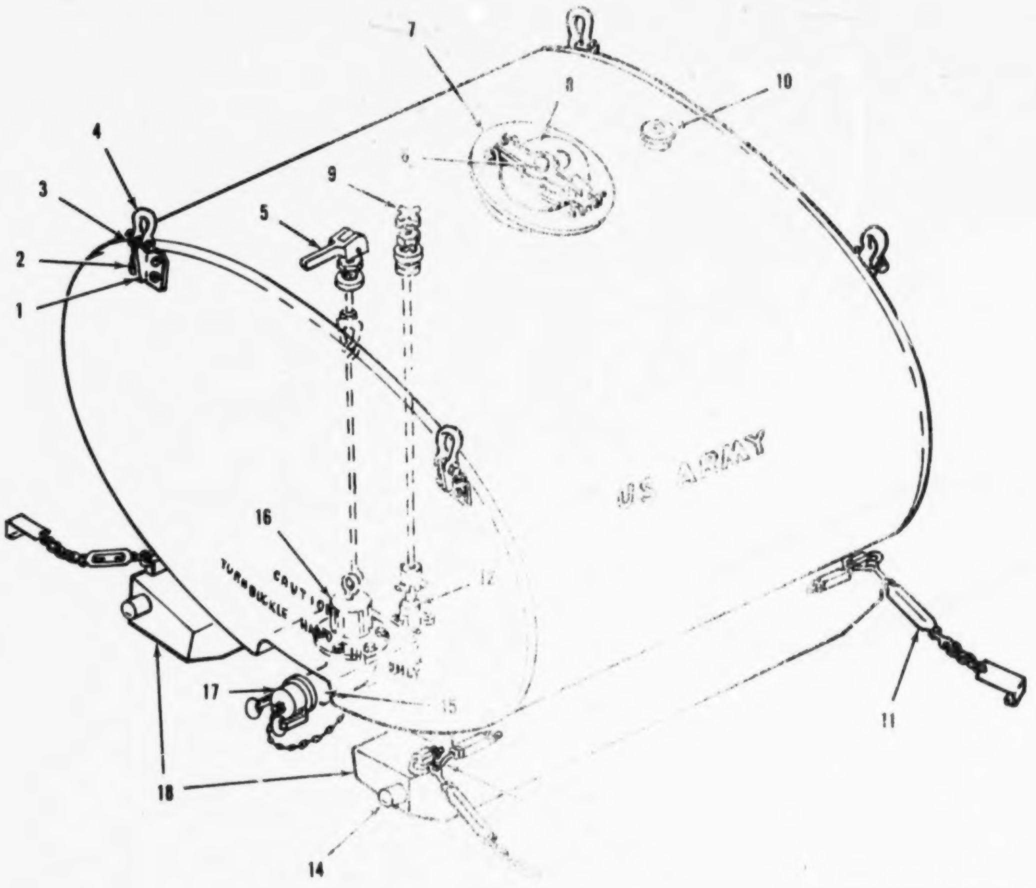
d. Reassembly. Refer to figure 3-35 and reassemble discharge valve.

e. Installation.

(1) Position valve body (20) on sump ring (8) and install nuts (24).

(2) Inside tank, place lift rod (7) in stem (12) and adjusting bale (6), and tighten adjusting bale.

(3) Replace manhole cover (para 3-42).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US ARMY
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CAUTION TURNBUCKLE HAND ONLY
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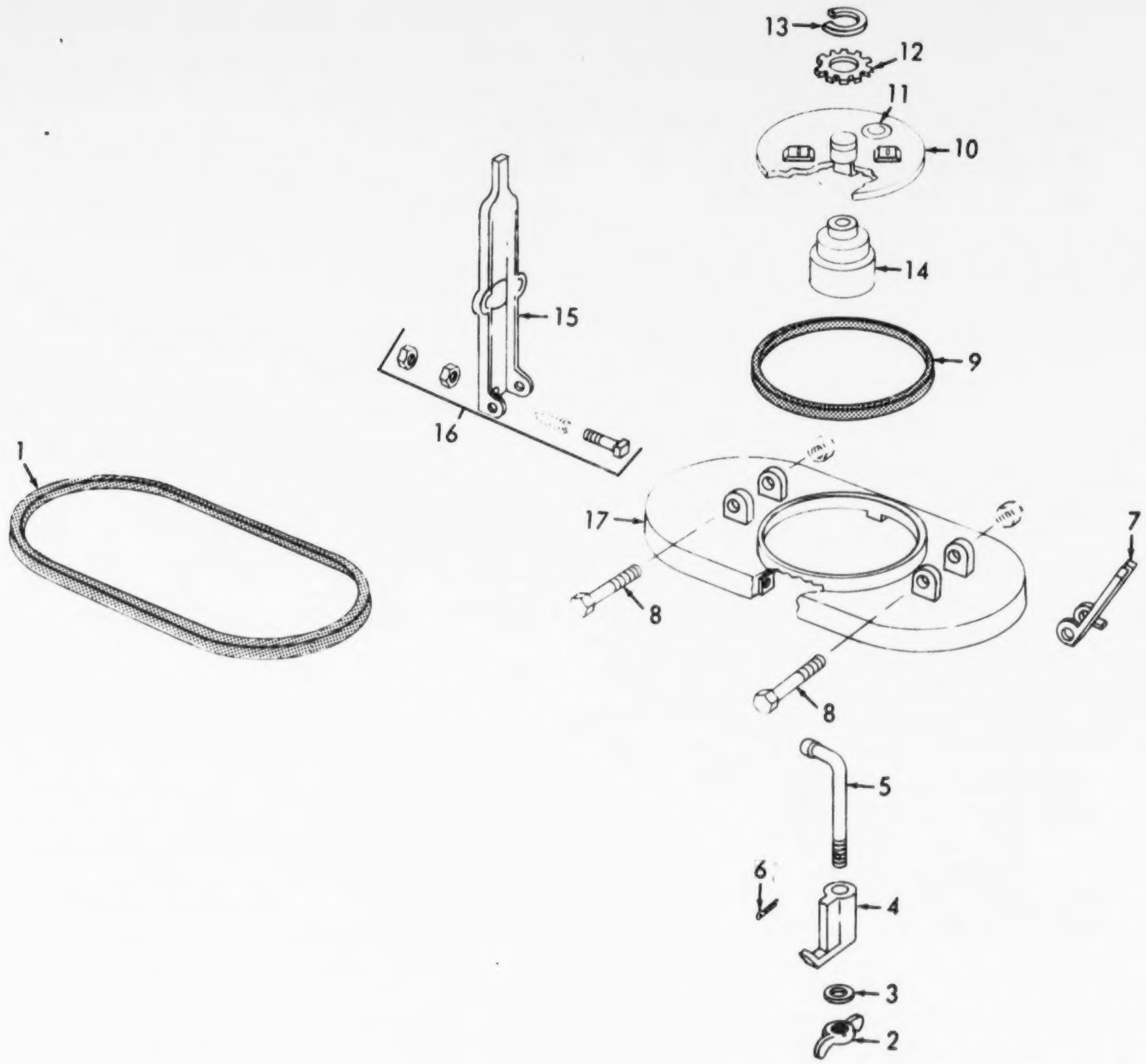
ME 4930-227-14/3-32

Figure 3-32. Tank assembly service.

1 Bracket (4)
2 Bolt (16)
3 Nut (4)
4 Lifting eye (4)
5 Control lever
6 Vent assembly
7 Manhole cover
8 Filler plug
9 Drain valve handle
10 Pump port
11 Tiedown assembly
12 Drain valve
13 Drag loop
14 Interlock
15 Valve body
16 Inlet strainer screen
17 Dust cap
18 Skids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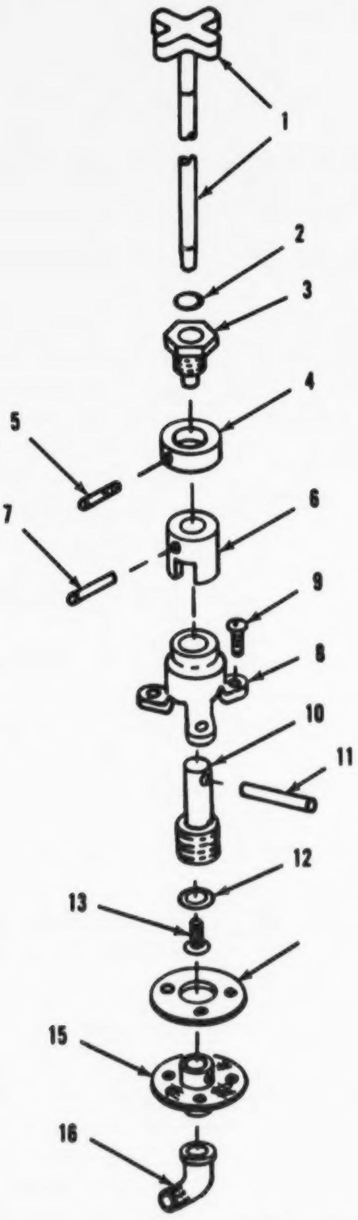
ME 4930-227-14/3-33

Figure 3–33. Manhole cover, removal and installation.

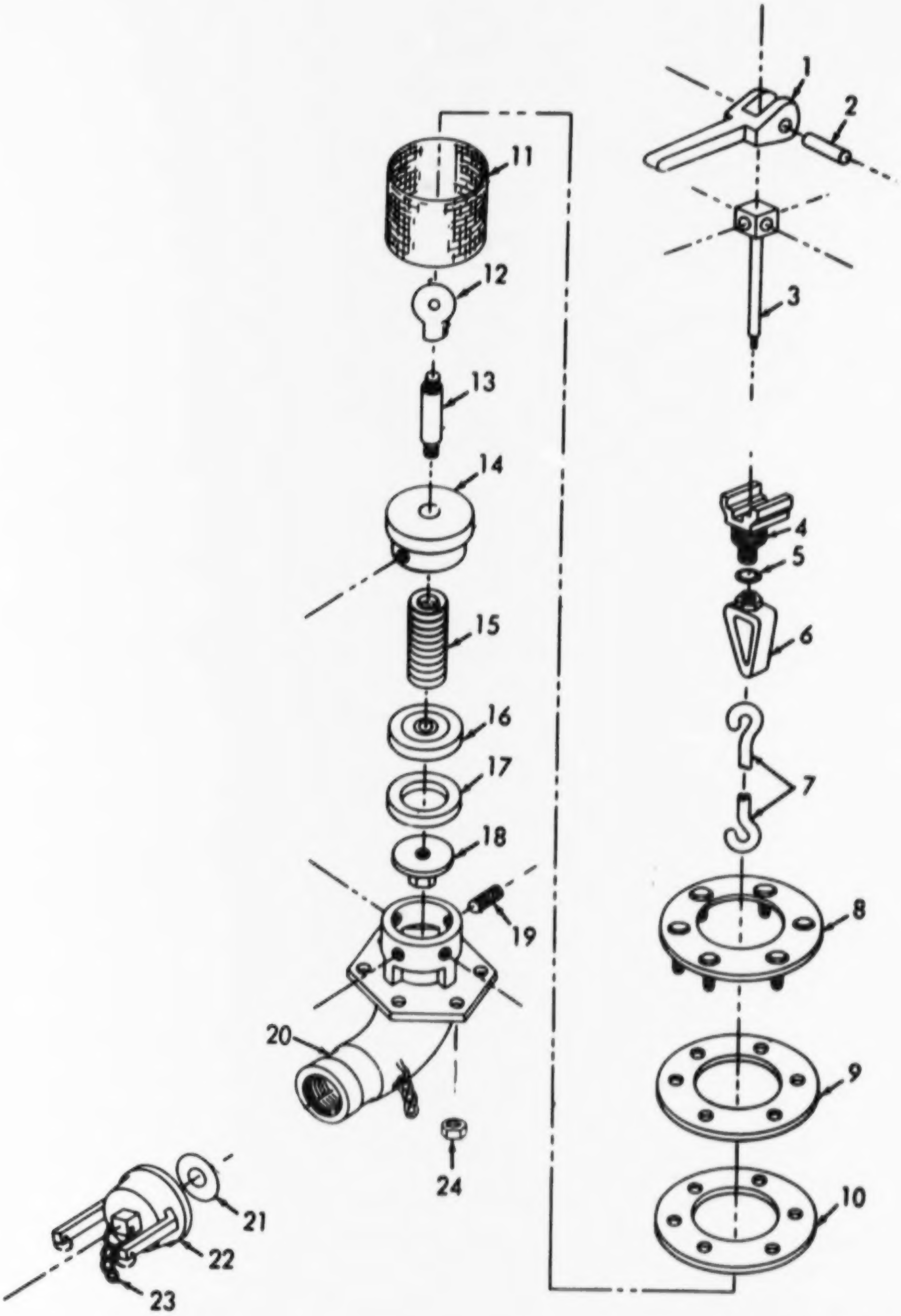
1 Gasket
2 Nut
3 Washer
4 Hook
5 Bolt
6 Pin
7 Cam
8 Bolt
9 Gasket
10 Cover
11 Plug
12 Spring
13 Ring
14 Vent
15 Hinge
16 Adjusting assembly
17 Cover



ME 4930-227-14/3-34

Figure 3-34. Drain valve assembly, disassembly and reassembly.

1 Rod and handle
2 O-ring
3 Support
4 Collar
5 Setscrew
6 Key
7 Pin
8 Stem retainer
9 Screw (3)
10 Stem
11 Stem pin
12 Washer
13 Screw
14 Gasket
15 Base
16 Elbow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ME 4930-227-14/3-35

Figure 3-35. Discharge valve assembly, disassembly and reassembly.

1 Control lever
2 Pin
3 Lever rod
4 Support
5 O-ring
6 Adjusting bale
7 Lift rod
8 Sump ring
9 Gasket
10 Gasket
11 Screen
12 Bale
13 Stem
14 Cap
15 Spring
16 Seat
17 Disk
18 Nut
19 Setscrew
20 Valve body
21 Gasket
22 Dust cap
23 Chain
24 Nut

CHAPTER 4

DEMOLITION OF EQUIPMENT TO PREVENT ENEMY USE

Section I. DEMOLITION TO RENDER EQUIPMENT INOPERATIVE

4-1. General

When capture or abandonment of the tank and pump unit is imminent, the responsible unit commander must make the decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all tank and pump units and all corresponding repair parts.

4-2. Demolition to Render Equipment Inoperative

a. Mechanical Means. To render the tank and pump unit inoperative by mechanical means, the operator should use a sledge hammer or pick to destroy the components in the following listed sequence.

b. Priority. When lack of time or personnel prevents complete destruction of equipment, the following priorities will be used in destruction of essential parts.

Priority	Parts
1	Carburetor/float bowl/ magneto
2	Engine block
3	Pump assembly

Section II. DEMOLITION BY OTHER METHODS

4-3. Demolition By Explosives or Weapons Fire

a. Explosives. Place charge of explosives, use the priorities outlined in paragraph 4-2, and detonate.

b. Weapons Fire. Several well-placed rounds of weapons fire will demobilize the units. For most effective destruction, use high explosive shoulder weapons (recoilless rifle, rocket launcher, etc.) or heavier artillery. Small caliber rifles or machine guns will be effective to some extent to pierce the major systems. Incendiary projectiles are recommended to increase the possibility of burning.

4-4. Other Demolition Methods

a. Scattering and Concealment of Parts. Should the possibility of capture be remote, such components as the carburetor, float bowl and magneto may be removed and concealed.

b. Submersion. Should submersion be attempted, make certain that essential parts will be exposed to the water, and that the water be deep enough to hide the sunken units.

c. Burning. Pack rags, clothing or canvas under, around and in the tank and pump unit. Saturate with gasoline, oil, or diesel fuel and ignite.

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT

Section I. GENERAL

5-1. Scope

These instructions are published for the use of direct support and general support maintenance personnel maintaining the tank and pump unit. They provide information on the maintenance of the tank and pump unit which is beyond the scope of the tools, equipment, personnel, or supplies normally available to using organizations.

5-2. Forms and Records

DA forms and records used for equipment maintenance will be only those prescribed in TM 38-750.

Section II. DESCRIPTION AND DATA

5-3. Description

For a complete description of the tank and pump unit, refer to paragraph 1-4.

5-4. Tabulated Data

a. General. This paragraph contains all tabulated data pertinent to direct support and general support maintenance personnel.

b. Nut and Bolt Torque Data. Refer to table 5-1.

Table 5-1. Nut and Bolt Torque Data

Cylinder head screws	14—18 ft-lb
Oil pan screw	6—8 ft-lb
Rod cap belt	14—18 ft-lb
Main bearing cap belt	14—18 ft-lb

c. Engine Overhaul Data.

Bore	2 7/8 in.
Stroke	2 3/4 in.
Displacement	17.8 cu in.
Rotation	Clockwise (flywheel end)
Brake horsepower	4.49 at 3,000 rpm
Spark plug gap	.030
Magneto points	0.015
Carburetor	Idle at 1,000—1,200 rpm

d. Engine Repair and Replacement Standards. Table 5-2 lists the manufacturer's sizes, tolerances, desired clearances, and maximum allowable wear and clearances.

Table 5-2. Repair and Replacement Standards.

Component	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear or clearance
	Min	Max	Min	Max	
Crankshaft					
Diameter of journal	1.000	1.001			
Clearance to connecting rod			0.007	0.002	0.002
Width of journal	1.000	1.005			
Connecting rod side clearance			0.006	0.013	0.013
End play (cold)			0.002	0.004	0.004
Piston					
Ring gap			0.012	0.022	0.022
Ring side					
Clearance in grooves:					
Top ring			0.002	0.0035	0.0035
2nd and 3rd ring			0.001	0.0025	0.0025
Oil ring			0.0025	0.004	0.004

Table 5-2. Repair and Replacement Standards—Continued

Component	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear or clearance
	Min	Max	Min	Max	
Cylinder to skirt clearance			0.006	0.0065	0.0065
Pin to connecting rod clearance			0.0002	0.0003	0.0008
Tappet to valve clearance (cold)					
Intake					0.008
Exhaust					0.014
Valve stem to guide clearance			0.003	0.005	0.007

Section III. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

5-5. Special Tools and Equipment

No special tools or equipment are required by direct support and general support maintenance personnel for performing maintenance on the tank and pump unit.

5-6. Direct Support and General Support Maintenance Repair Parts

Direct support and general support maintenance repair parts are listed and illustrated in TM 5-4930-227-24P.

5-7. Specially Designed (Fabricated) Tools and Equipment

No specially designed tools or equipment are required for direct support and general support maintenance of the tank and pump unit.

Section IV. TROUBLESHOOTING

5-8. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the tank and pump units, or any of their components. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

5-9. Direct Support and General Support Maintenance Troubleshooting

Refer to table 5-3.

Table 5-3. Troubleshooting.

Malfunction	Probable cause	Corrective action
1. Engine fails to start	*a.* Valves or valve seat defective	*a.* Repair or replace valves or valve seat (para 6-4).
	b. Compression weak	*b.* Replace piston rings (para 6-6).
2. Excessive oil consumption	*a.* Piston rings worn or broken	*a.* Replace piston rings (para 6-6).
	b. Cylinder wall worn or scored	*b.* Replace crankcase (para 6-4).
	c. Oil pump not operating effectively	*c.* Replace damaged oil pump parts (para 6-5).
	d. Main or connecting rod bearing faulty	*d.* Replace damaged bearings (para 6-4).
3. Knock in engine	*a.* Loose or burned out connecting rod bearing	*a.* Overhaul engine.
	b. Loose or worn piston pin	*b.* Replace piston, piston pin and connecting rod as necessary (para 6-6).
4. Engine smokes excessively	*a.* Piston or rings worn *or* damaged	*a.* Replace piston or rings (para 6-6).
	b. Cylinder walls scored or worn	*b.* Replace crankcase (para 6-4).

CHAPTER 6

REPAIR INSTRUCTIONS

Section I. ENGINE COMPONENTS

General

ylinder Head. The cylinder head covers the
the cylinder and provides a mounting port
e spark plug. It is finned to help dissipate
at of engine combustion.
alve Tappets. Intake and exhaust valves
appets which raise the valves at the re-
portion of the engine operation cycle.
tappets operate in conjunction with the
aft. Valve tappet clearance can be checked
t major engine disassembly, but it cannot
usted without disassembly.

Cylinder Head

emoval.
) Remove the spark plug (para 3–23).
) Remove the air shroud (para 3–20).
) Refer to figure 6–1 and remove the
er head and gasket.
leaning and Inspection.
) Discard the cylinder head gasket. Clean
linder head and cylinder head bolts with
proved cleaning solvent; scrape carbon de-
from the cylinder head, taking care not to
n sealing surfaces.
) When the cylinder head is removed,
the top of the cylinder block, carefully re-
g carbon from piston tops and from around
lve head and seats. Take care not to scratch
e valve seats.
3) Inspect the cylinder head for cracks,
ng, broken cooling fins, spark plug port
s, and other damage. Straighten bent cool-
ns. Replace a damaged cylinder head.
nstallation.
1) Refer to figure 6–1 and install the cylin-
ad, using a new gasket.
2) Install the air shroud (para 3–20).
3) Install the spark plug (para 3–23).
4) After installation of air shroud, torque
linder head mounting bolts, following the
nce shown in figure 6–2.

6–3. Tappet Cover Plate and Tappets

a. Removal. Refer to figure 6–3 and remove the tappet cover plate.

b. Cleaning and Inspection.

(1) Clean the cover plate and accessible metal parts with an approved cleaning solvent and dry thoroughly.

(2) Measure valve clearance (fig. 6–3) and inspect for defective valve springs, tappets, rotators, and seats.

c. Installation. Refer to figure 6–3 and install the tappet cover plate.

6–4. Valves, Valve Seats, Guides, and Springs

a. Removal.

(1) Remove the engine (para 3–17).

(2) Remove the carburetor (para 3–28).

(3) Remove the muffler (para 3–31).

(4) Remove the cylinder head (para 6–2).

(5) Remove the tappet cover plate (para 6–3).

b. Disassembly. Refer to figure 6–4 and disassemble the valves, valve seats, guides and springs.

c. Cleaning, Inspection, and Repair.

(1) Clean the valves with a wire brush to remove all carbon deposits. Clean valve seats, ports, and guides in cylinder block; clean top of cylinder block. Wash springs with an approved cleaning solvent and dry thoroughly.

(2) Inspect valves for burned, pitted, or cracked faces; replace a burned, cracked, or deeply pitted valve.

(3) Inspect valve springs for cracks or pitting. Replace cracked or pitted springs.

(4) Inspect valve seat insert for looseness and pitting. Replace a defective valve seat insert in the following manner:

(*a*) Use a puller to remove the insert from the exhaust valve opening.

(*b*) Clean all carbon out of the insert counterbore in the cylinder block and clean the valve stem guide bore.

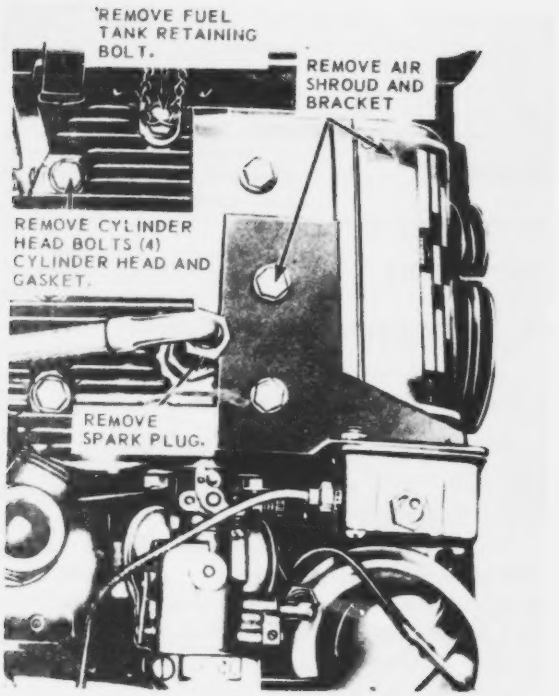
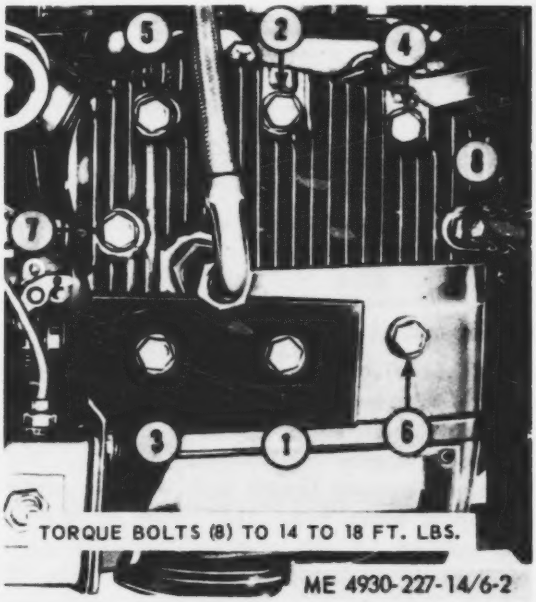

REMOVE FUEL TANK RETAINING BOLT.
REMOVE AIR SHROUD AND BRACKET
REMOVE CYLINDER HEAD BOLTS (4) CYLINDER HEAD AND GASKET.
REMOVE SPARK PLUG.
ME 4930-227-14/6-1

Figure 6–1. Cylinder head, removal and installation.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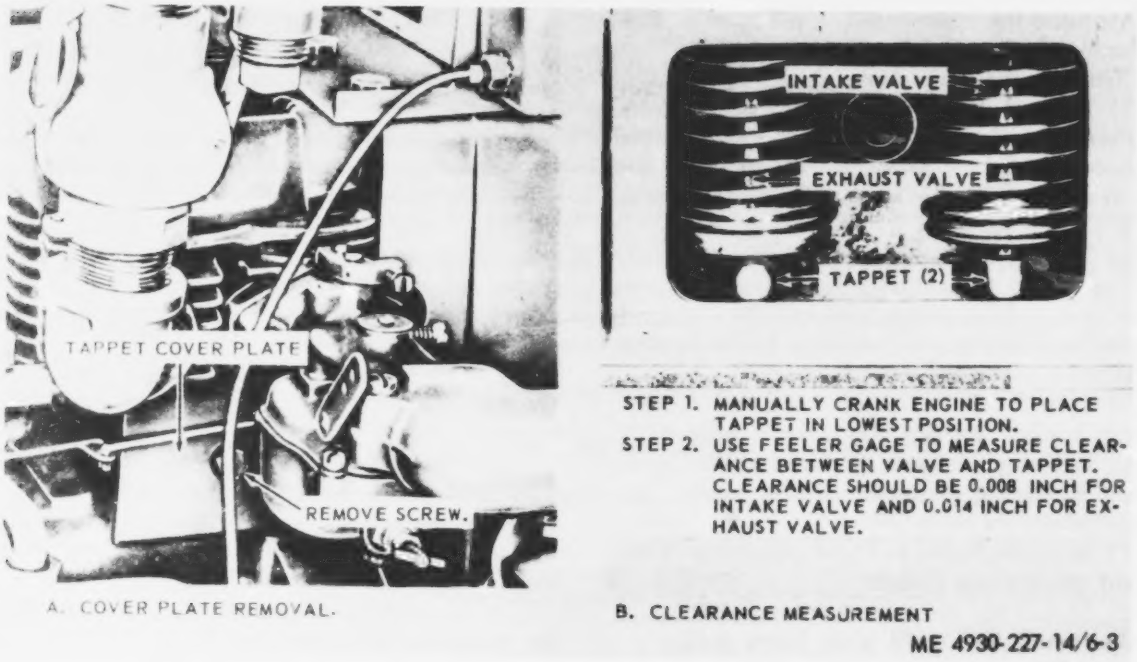
TORQUE BOLTS (8) TO 14 TO 18 FT. LBS.
ME 4930-227-14/6-2

Figure 6–2. Cylinder head bolts, tightening sequence.


TAPPET COVER PLATE
REMOVE SCREW.
INTAKE VALVE
EXHAUST VALVE
TAPPET (2)
ME 4930-227-14/6-3

STEP 1. MANUALLY CRANK ENGINE TO PLACE TAPPET IN LOWEST POSITION.

STEP 2. USE FEELER GAGE TO MEASURE CLEARANCE BETWEEN VALVE AND TAPPET. CLEARANCE SHOULD BE 0.008 INCH FOR INTAKE VALVE AND 0.014 INCH FOR EXHAUST VALVE.

A. COVER PLATE REMOVAL.

B. CLEARANCE MEASUREMENT

Figure 6–3. Tappet cover plate, removal, installation, and clearance measurement.

(*c*) Finish the counterbore in the cylinder ock to provide the correct bore-to-insert inter- rence. Chill the insert with dry ice and, using pilot driver, tab the insert into place with ht blows. Peen the insert to anchor in place.

(*d*) Reface the insert, if necessary, to make seat concentric with the valve stem bore. Check ncentricity with a dial indicator.

(*e*) Grind valve in seat to form a gas- ght seat.

d. *Regrinding Valves.*

(1) Using a valve seat grinding tool, grind e seats at a 45° angle and then grind the lve faces at a 45° angle with a valve refacer inder.

(2) Valves must be lapped with a suitable pping compound or they will leak within the rst few hours of operation because of improper ating.

(3) Clean valve seat and faces with an ap- roved cleaning solvent and dry thoroughly.

(4) After lapping the valves, remove them om the block and wash the valves and block ith an approved cleaning solvent.

e. *Reassembly.* Refer to figure 6-4 and reas- emble valves.

f. Installation.

(1) Install tappet cover plate (para 6-3).

(2) Install cylinder head (para 6-2).

(3) Install muffler (para 3-31).

(4) Install carburetor (para 3-28).

(5) Install engine (para 3-17).

5. Engine Base and Oil Pump

a. Removal.

(1) Remove the engine (para 3-17).

(2) Refer to figure 6-5 and remove the ngine base and oil pump.

b. Disassembly. Refer to figure 6-6 and disas- semble the engine base and oil pump.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved clean- ing solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage.

(3) Inspect all hardware for damaged or stripped threads.

(4) Replace a damaged or defective part.

d. Reassembly. Refer to figure 6-6 and reas- semble the engine base and oil pump.

e. Installation.

(1) Refer to figure 6-5 and install the en- gine base and oil pump.

(2) Install the engine (para 3-17).

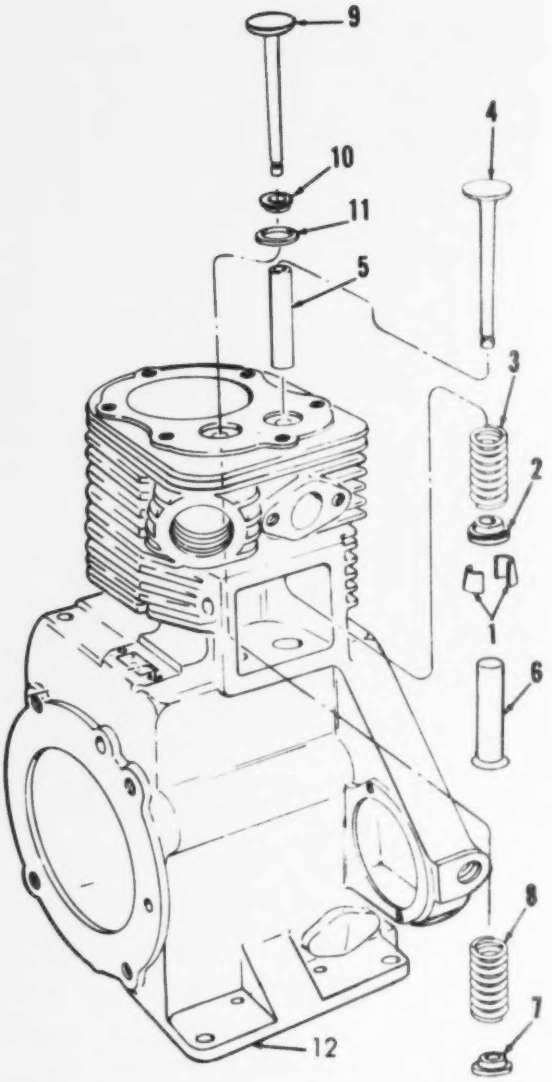
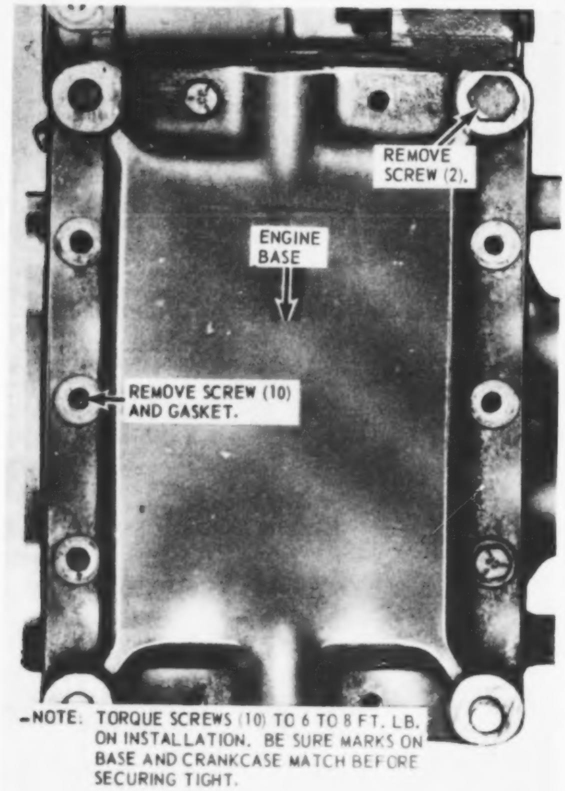


Figure 6-4. Valves, removal, disassembly, reassembly and installation.

1 Lock (4)
2 Spring seat
3 Spring
4 Intake valve
5 Guide
6 Tappet (2)
7 Rotator
8 Spring
9 Exhaust valve
10 Cup (2)
11 Insert
12 Crankcase



NOTE: TORQUE SCREWS (10) TO 6 TO 8 FT. LB. ON INSTALLATION. BE SURE MARKS ON BASE AND CRANKCASE MATCH BEFORE SECURING TIGHT.

ME 4930-227-14/6-5

Figure 6–5. Engine base and oil pump, removal and installation.

6–6. Piston and Connecting Rod

a. Removal.

(1) Remove the engine base (para 6–5).

(2) Remove the cylinder head (para 6–2).

(3) Refer to figure 6–7 and remove the piston and connecting rod.

b. Disassembly. Refer to figure 6–8 and disassemble the piston and connecting rod.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for cracks, breaks, and other damage. Replace a damaged or defective part.

(3) Inspect the mounting hardware for damaged or stripped threads. Replace a damaged or defective part.

d. Reassembly. Refer to figure 6–8 and reassemble the piston and connecting rod.

6–7. Crankshaft

a. Removal.

(1) Remove the piston and connecting rod (para 6–6).

(2) Refer to figure 6–9; remove the crankshaft.

b. Disassembly. Refer to figure 6–10 and disassemble the crankshaft.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect crankshaft for scoring. Hone crankshaft to remove any slight scoring or replace a damaged or defective crankshaft.

(3) Inspect the bearing cones and cups. Replace a defective assembly.

(4) Inspect the gear and woodruff key for wear or other damage. Replace defective parts.

(5) Inspect the hardware for stripped or damaged threads, rust, or damage incurred during removal. Replace damaged or defective parts.

d. Reassembly. Refer to figure 6–10 and reassemble the crankshaft.

e. Installation.

(1) Refer to figure 6–9 and install the crankshaft.

(2) Install the piston and connecting rod (para 6–6).

6–8. Camshaft and Governor Assembly

a. Removal.

(1) Remove the crankshaft (para 6–7).

(2) Refer to figure 6–11 and remove the camshaft.

b. Disassembly. Refer to figure 6–11 and disassemble the camshaft and governor.

c. Cleaning, Inspection and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the camshaft for alinement, scoring, roughness, or damaged or chipped gear teeth.

(3) Repair any slight roughness by honing or replace a damaged or scored camshaft.

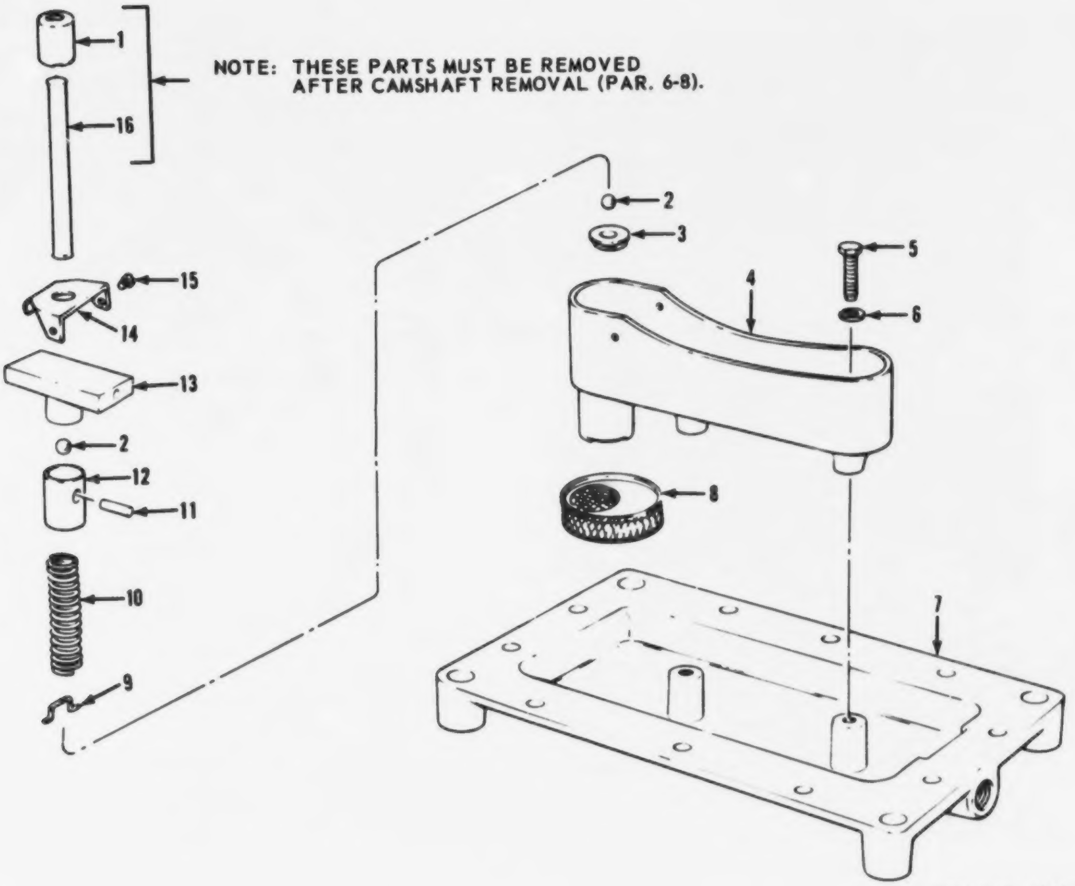
(4) Replace a badly damaged or worn sleeve bearing, spacer, or pin.

d. Reassembly. Refer to figure 6–11 and reassemble the camshaft and governor.

e. Installation.

(1) Refer to figure 6–11 and install camshaft.

(2) Install the crankshaft (para 6–7).



NOTE: THESE PARTS MUST BE REMOVED AFTER CAMSHAFT REMOVAL (PAR. 6-8).

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2
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2
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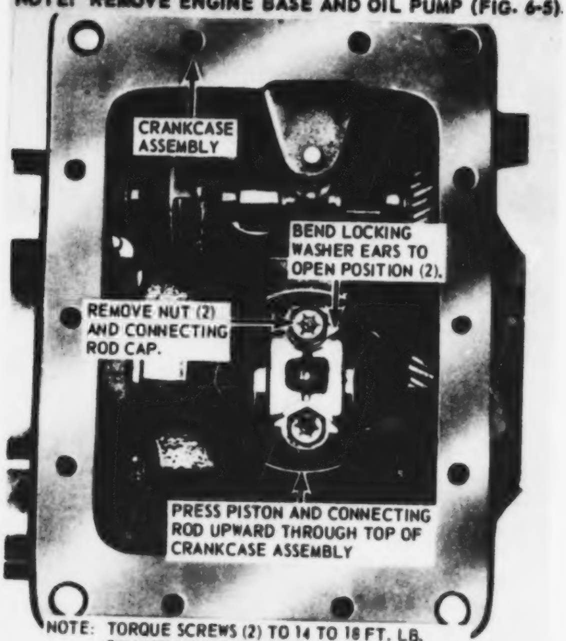
ME 4930-227-14/6-6

Figure 6–6. Engine base and oil pump, disassembly and reassembly.

1 Cap
2 Ball (2)
3 Seat
4 Body
5 Screw (2)
6 Washer
7 Engine Base
8 Strainer
9 Retainer
10 Spring
11 Pin
12 Plunger
13 Cap
14 Cover
15 Screw (2)
16 Rod

NOTE: REMOVE ENGINE BASE AND OIL PUMP (FIG. 6-5).

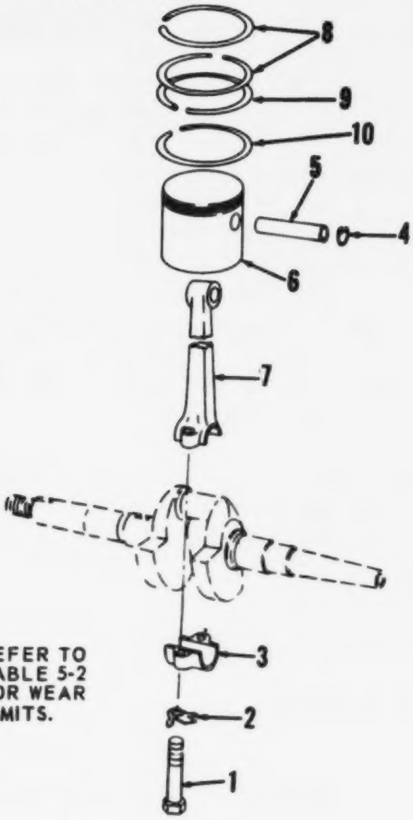

CRANKCASE ASSEMBLY
BEND LOCKING WASHER EARS TO OPEN POSITION (2).
REMOVE NUT (2) AND CONNECTING ROD CAP.
PRESS PISTON AND CONNECTING ROD UPWARD THROUGH TOP OF CRANKCASE ASSEMBLY

NOTE: TORQUE SCREWS (2) TO 14 TO 18 FT. LB. ON INSTALLATION. MATCH ARROW MARKINGS ON CONNECTING ROD AND CAP.

ME 4930-227-14/6-7

Figure 6–7. Piston and connecting rod, removal and installation.

NOTE: ON REASSEMBLY STAGGER PISTON RING GAPS AS SHOWN.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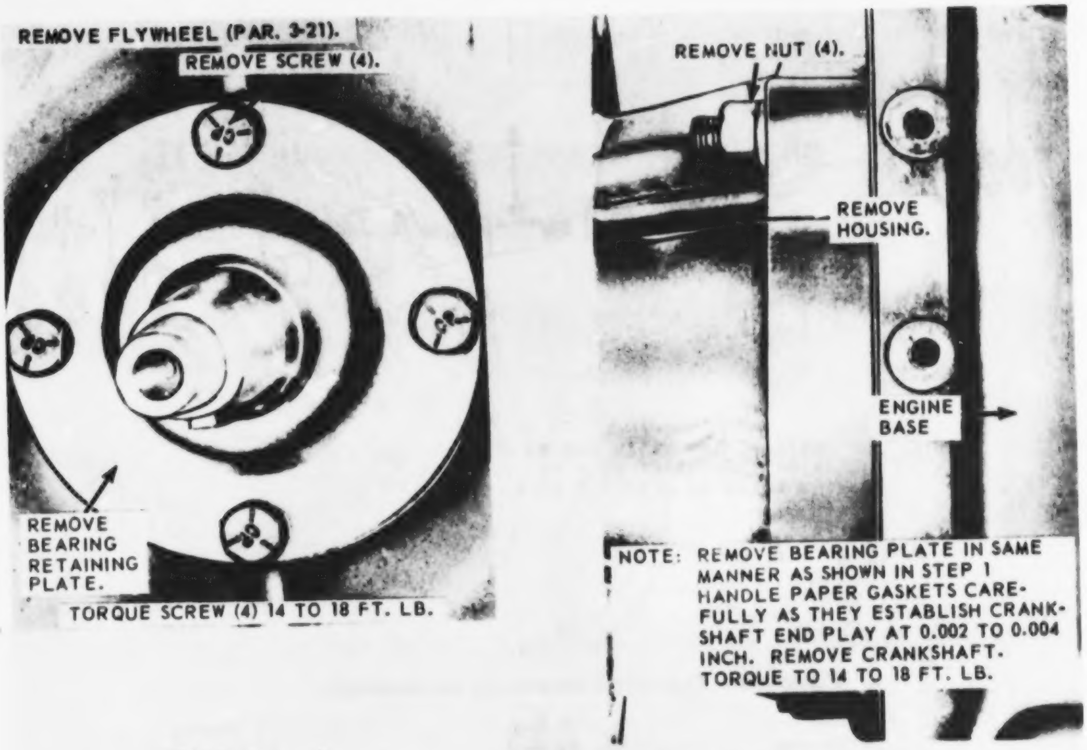
7
3
2
1

NOTE: REFER TO TABLE 5-2 FOR WEAR LIMITS.

ME 4930-227-14/6-8

Figure 6–8. Pistons and connecting rod, disassembly and reassembly.

1 Screw
2 Washer
3 Cap
4 Retainer
5 Piston pin
6 Piston
7 Connecting rod
8 Compression ring
9 Scraper ring
10 Oil ring



REMOVE FLYWHEEL (PAR. 3-21).

REMOVE SCREW (4).

REMOVE BEARING RETAINING PLATE.

TORQUE SCREW (4) 14 TO 18 FT. LB.

REMOVE NUT (4).

REMOVE HOUSING.

ENGINE BASE

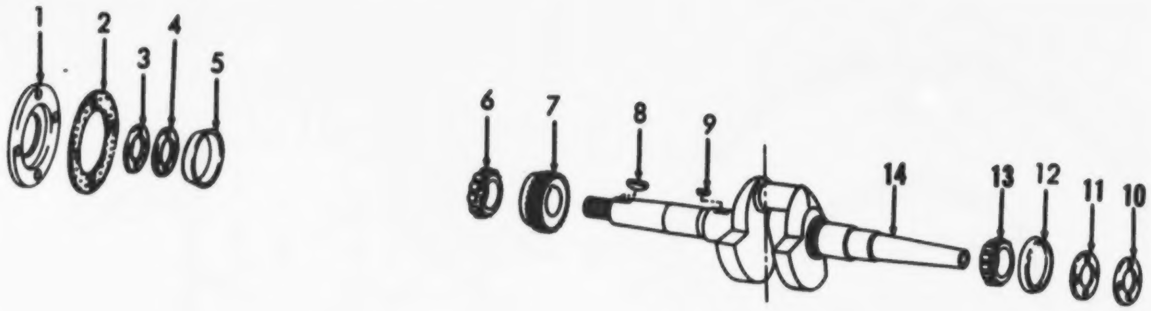
NOTE: REMOVE BEARING PLATE IN SAME MANNER AS SHOWN IN STEP 1 HANDLE PAPER GASKETS CAREFULLY AS THEY ESTABLISH CRANKSHAFT END PLAY AT 0.002 TO 0.004 INCH. REMOVE CRANKSHAFT. TORQUE TO 14 TO 18 FT. LB.

STEP 1. REMOVE RETAINING PLATE.

STEP 2. REMOVE CRANKSHAFT

ME 4930-227-14/6-9

Figure 6-9. Crankshaft, removal and installation.

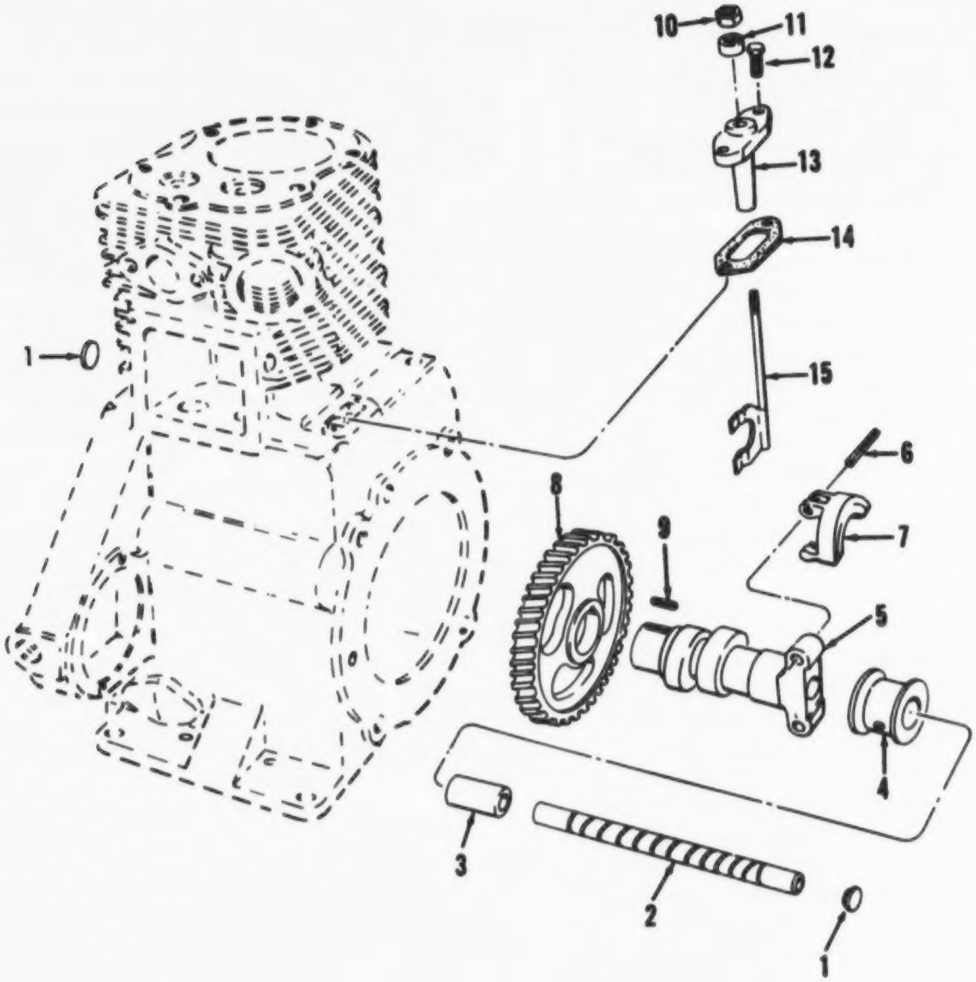


NOTE: ON INSTALLATION MATCH TIMING MARKS ON CRANKSHAFT GEAR TO TIMING MARKS ON CAMSHAFT GEAR.

ME 4930-227-14/6-10

Figure 6–10. Crankshaft, disassembly and reassembly.

1 Plate
2 Gasket
3 Seal
4 Retainer
5 Cup
6 Bearing
7 Gear
8 Key
9 Key
10 Seal
11 Retainer
12 Cup
13 Bearing
14 Crankshaft



ME 4930-227-14-6-11

Figure 6-11. Camshaft and governor, removal, disassembly, reassembly and installation.

1 Plug (3)
2 Pin
3 Spacer
4 Sleeve
5 Camshaft
6 Pin (2)
7 Flyweight assembly (2)
8 Gear
9 Key
10 Nut
11 Bearing
12 Screw
13 Bracket
14 Gasket
15 Yoke

Section II. TANK AND FRAME

6-9. Tank and Frame

The tank shells are of durable aluminum construction; the frame is of welded sheet metal. The tank and frames will require a minimum of maintenance. Make certain every precaution is taken prior to attempting any repair on a tank.

6-10. Welding Repairs

a. Tanks. No repair will be initiated until the tank has been thoroughly vented and cleaned. Observe necessary precautions and weld the damaged area in accordance with standard techniques. Refer to paragraph 6-10*d* for welding precautions.

b. Frame. Make certain the frame is free of dirt, oil, grease, or other foreign matter, and bare metal is exposed for welding. Remove necessary components before welding.

c. Tank Cleaning. The tank must be free of explosive vapors and thoroughly cleaned before any repairs are attempted; drain the tank of all contents and open filler plug, allow filler to remain open for several minues. If compressed air is available, blow out the tank. Clean the tank interior with an approved solvent and dry thoroughly. Precautions and procedures outlined in TM 10-1114 will be adapted to the tank. Areas of the tank to be subjected to severe heat must be cleaned to the bare metal; use a stiff stainless steel wire brush or other suitable tool for this purpose. Pay particular attention to the seams; heat from a welding torch tends to volatilize tetraethylened deposits, causing toxic fumes. The tank exterior must be cleaned of all dirt, sand, oil, or other foreign matter with a solution of trisodium phosphate and water; rinse with plain water and dry. Remove paint from any area to be welded.

d. Welding Precautions.

(1) Completely drain all fuel from tank to be purged; be sure the drained fuel is removed from the area where work will be performed.

(*a*) Remove all fuel from floor; remove all fuel-soaked rags and waste from area.

(*b*) If electrical welding is to be performed, be sure you have adequate shielding to protect other workers from injury.

(*c*) This process is to be undertaken by field and depot maintenance units. Supporting agencies will furnish additional skills and equipment when required.

(2) Essentials:

(*a*) Efficient purging of fuel tanks, pipe lines, pump housings, hoses, and distribution manifolds *may* be accomplished by adherence to procedures outlined herein.

(*b*) Materials required:

1. Adequate source of water with a large diameter hose long enough to reach the vehicle or fuel tank.

2. Compressed air source and air hose of sufficient length to reach depth of fuel tank.

3. Sufficient quantity of gas tank purger obtainable through local procurement. Only known source available to date: Product-Sol, Inc., 2010 Cole, Birmingham, Mich.

(3) Safety precaution:

***Warning:* Prior to and during all operations outlined in this bulletin, coordinate with safety, medical, and fire departments to comply with safeguards contained herein and other applicable directives.**

(*a*) The tank being purged *must* have a static ground during all operations; caution should be taken with all tools and metal objects around tank to insure no contact of sufficient force is made to create a spark.

(*b*) Conduct a combustible vapor test reading prior to purging the tank, using an acceptable explosive meter, such as MSA explosive meter 6665-664-4650 or Davis Vapotester 6665-562-8103.

(*c*) Only competent personnel, thoroughly instructed in the proper handling and reading of the vapor-indicating instruments (explosion meter), will perform vapor tests.

(*d*) Conduct a combustible vapor test reading immediately after purging. Under no circumstances will repair of fuel tank begin until declared safe by safety personnel.

(*e*) Discontinue all operations if an electrical storm is threatening or in progress.

(*f*) Eliminate all possible causes of explosion.

(*g*) Personnel engaged in purging operations will:

1. NOT wear wool, nylon, silk, rayon or other similar static electricity-generating clothing.

2. Wear clean cotton clothing with no metal buttons or fittings. Remove all contents from pockets.

3. Wear rubber boots.

4. Use cotton waste for cleaning purposes. Other material may generate static electricity.

(4) Preparation of equipment:

(*a*) Completely drain each fuel tank or fuel tank compartment, all piping, pumps, meters, filters, and segregators, as applicable.

(*b*) Remove all accessory items, such as gages and floats, which might entrap fuel.

(*c*) Close or seal all drains (it may be necessary to locally fabricate covers for some types of drains).

(*d*) Fill fuel tank and overflow for five minutes with cold water.

(*e*) Drain fuel tank completely.

(*f*) Close or seal drains.

***Caution:* Insufficient amount of chemical will result in an incomplete purging. Accurate computations of amount of chemical to be added must be made prior to the purging. Once purging has begun, do not stop until process is complete.**

(*g*) For each 100 gallon capacity, add 40 fluid ounces to the fuel tank. (This is equivalent to 8 fluid ounces of concentrate for a 20-gallon fuel tank).

(*h*) Fill fuel tank to top with water. Do not overflow.

(*i*) Insert air line into fuel tank filler neck opening and agitate solution with 3 to 5 psi of air for five minutes. Frequently move air hose around in tanks, covering as much area as possible, especially near the bottom and around baffles.

(*j*) Remove air line and drain solution from fuel tank.

(*k*) Fill fuel tank and overflow for five minutes with cold water or until water is clear.

(*l*) Drain fuel tank completely.

(*m*) Conduct a combustible vapor test reading to determine if fuel tank is safe to repair, clean, or paint, store or change material. *If combustible vapor test reading indicates tank is not safe, repeat procedures as cited in h through m above.*

6–11. Protective Finish

All normally painted exterior surfaces of the tank must be protected by enamel at all times. A primer and semi-gloss enamel shall be used. The primer should conform to specification TT-P-666, and the enamel to specification TT-E-529. Use standard Army olive drab color 2430. Refer to TM 9-231 for general instructions.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers for Army Users.

A-2. Lubrication

C9100IL	Fuels, Lubricants, Oils and Waxes.
LO 5-4930-227-12	Lubrication Order.

A-3. Painting

TM 9-213	Painting Instructions for Field Use.

A-4. Maintenance

TM 5-4930-227-24P	Operator, Organizational, Direct and General Support Maintenance Repair Parts and Special Tools Lists.
TM 10-1101	Petroleum Handling Equipment Operations.
TM 10-1113	Petroleum Tank-Vehicle Operations.
TM 10-1114	Cleaning Bulk Petroleum Storage, Tanks, Railway Tank Cars, and Tank Trucks.
TM 38-750	Army Equipment Record Procedures.
TB 1047	Elimination of Combustibles in Fuel Tanks.

A-5. Shipment and Storage

TB 740-90-1	Administrative Storage of Equipment.
TB 740-93-2	Preservation of USAMECOM Mechanical Equipment for Shipment and Storage.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B–1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II. (Not applicable.)

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

B–2. Explanation of Columns in Section II

a. Group Number, Column (1). The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750–93–1, Functional Grouping Codes) are listed on the MAC (Maintenance Allocation Chart) in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Functional Group, Column (2). This column contains a brief description of the components of each functional group.

c. Maintenance Functions, Column (3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

C—Operator or crew
O—Organizational maintenance
F—Direct support maintenance
H—General support maintenance
D— Depot maintenance

The maintenance functions are defined as follows:

A—Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B—Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C—Service. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D—Adjust. To rectify to the extent necessary to brint into proper operating range.

E—Aline. To adjust specified variable elements of an item to bring to optimum performance.

F—Calibrate. To determine the corrections to be made in the reading of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G—Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H—Replace. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I—Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J—Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

K—Rebuild. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. Tools and Equipment, Column (4). This column is provided for referencing by code the special tools and test equipment (sec. III) required to perform the maintenance functions (sec. II).

e. Remarks, Column (5). This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

B-3. Explanation of Columns in Section III

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE (Tool and Test Equipment) requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Level. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal stock number of tools and test equipment.

B-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to section II. The first letter references column (5) and the second letter references a maintenance function, column (3), A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(1)	(2)	(3) Maintenance functions											(4)	(5)
Group No.	Function group	A Inspect	B Test	C Service	D Adjust	E Aline	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	Tools and equipment	Remarks
01	ENGINE													
0100	Engine Assembly:													
	Engine assembly	C	F	C	--	--	--	--	O	F	H	--	------	A
0105	Valves, Camshafts and Timing System:													
	Valves; seat	--	--	--	--	--	--	--	F	F	--	--	------	B
0106	Engine Lubrication System													
	Breather, crankcase	--	--	C	--	--	--	--	O					
03	FUEL SYSTEM													
0301	Carburetor:													
	Carburetor	--	--	--	O	--	--	--	O	O	--	--	------	C
0304	Air Cleaner													
	Air cleaner assembly	--	--	C	--	--	--	--	O					
0306	Tanks, Lines, Fittings, Headers:													
	Tank, fuel	--	--	C	--	--	--	--	O					
0309	Fuel Filters:													
	Strainer, sediment	-	--	C	--	--	--	--	O					
06	ELECTRICAL SYSTEM													
	Ignition Components:													
	Magneto, ignition	--	--	--	O	--	--	--	O	O				
	Spark plug	--	O	O	O	--	--	--	O					
18	BODY, CAB, HOOD AND HULL													
1811	Tank Bodies	--	--	--	--	--	--	--	O	F				
22	BODY, CHASSIS OR HULL AND ACCESSORY ITEMS													
2202	Accessory Items													
	Hose assemblies	--	F	--	--	--	--	--	O					
	Nozzle	--	--	--	--	--	--	--	O	O				
55	PUMPS													
5500	Pump Assembly:													
	Pump, centrifugal	--	--	--	--	--	--	--	O	O				
76	FIREFIGHTING EQUIPMENT COMPONENTS													
7603	Fire Extinguishers:													
	Fire extinguishers	--	--	C	--	--	--	--	O					

Section III. SPECIAL TOOL AND TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance level	Nomenclature	Tool number
		Not applicable	

Section IV. REMARKS

Reference code	Remarks
A—F	Test of engine includes operation and compression.
B—H	Repair of valves and seats includes refacing.
C—H	Repair to carburetor, replace bowl gasket only.

APPENDIX C

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists items which accompany the tank and pump unit or are required for installation, operation, or operator's maintenance.

C-2. General

This basic issue items list is divided into the following sections:

a. Basic Issue Items—Section II. A list of items which accompany the tank and pump unit and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies—Section III. A listing of maintenance and operating supplies required for initial operation.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of basic issue items, section II.

a. Source, Maintenance, and Recoverability Codes (SMR), Column (1).

(1) Source code, indicates the selection status and source for the listed item. Source code is:

Code	Explanation
P	Applied to repair parts which are stocked in or supplied from GSA/DSA or Army supply system, and authorized for use at indicated maintenance categories.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew.

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable.

b. Federal Stock Number, Column (2). This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description, Column (3). This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers, in parentheses. Repair parts quantities included in kits, sets, and assemblies, are shown in front of the repair part name.

d. Unit of Measure (u/m), Column (4). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based; e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit, Column (5). This column indicates the quantity of the item used in the functional group or the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment, Column (6). This column indicates the quantity of an item furnished with the equipment.

g. Illustration, Column (7). This column is divided as follows:

(1) *Figure number, column (7)(A).* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number, column (7)(B).* Indicates the callout number used to reference the item in the illustration.

C-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

a. Component Application. Column (1). This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number, Column (2). This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description, Column (3). This column indicates the item name and brief description.

d. Quantity Required for Initial Operation, Column (4). This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours' Operation, Column (5). This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes, Column (6). This column indicates informative notes keyed to data appearing in a preceding column.

C-5. Special Information

Not applicable.

Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description Ref No. & mfr code Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration (A) Fig No.	(7) Illustration (B) Item No.
		GROUP 31—BASIC ISSUE ITEMS, MANUFACTURER INSTALLED 3100—BASIC ISSUE ITEMS, MANUFACTURER OR DEPOT INSTALLED					
PC	7510-889-3494	BINDER, LOOSE LEAF: 3-ring type fasteners, blind embossed, printed- -U.S. Army Equipment Log Book: for replacement envelope see FSN 7510-763-5996.	EA		1		
PC	7520-559-9618	CASE, MAINTENANCE AND OPERATIONAL MANUAL: w/1 pocket 16 in. H, 1 1/8 in. deep, 9 3/4 in. lg and 1 pocket 16 in. H, 1 3/8 in. deep, 9 in. H, 12 3/4 in. lg, MIL-B-11743.	EA		1		
		DEPARTMENT OF THE ARMY TECHNICAL MANUAL: Operator, Organizational, Direct and General Support Maintenance Manual TM 5-4930-227-14.	EA		1		
		LUBRICATION ORDER: LO 5-4930-227-12.	EA		1		

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required f/initial operation	(5) Quantity required f/8 hrs operation	(6) Notes
Air Cleaner		Oil, Lubricating (3)			(1) Include quantity of oil to fill engine oil system as follows: 1 qt crankcase 1/8 qt air cleaner (2) Reference current LO for grade application and replenishment intervals. (3) Use oil as prescribed in crankcase. (4) Tank capacity. (5) Average fuel consumption is 0.58 gal per hour of continous operation.
Crankcase (1)		Oil, Lubricating: as follows			
	9150-265-9433	Grade OE30	1 1/8 qt	(2)	
	9150-265-9425	Grade OE10	1 1/8 qt	(2)	
	9150-242-7602	OES	1 1/8 qt	(2)	
Fuel Tank		Fuel, Gasoline: bulk as follows:			
	9130-160-1818	Gasoline: automotive combat 91A	1 gal (4)	5 gal (5)	
	9130-160-1830	Gasoline: automotive combat 91C	1 gal (4)	5 gal (5)	
Grease Points	9150-190-0904	Grease: automotive and artillery GAA 1-lb can (2)	1 lb	1 lb	

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Carburetor	3–28	3–20
Connecting rod, piston	6–6	6–4
Controls and instruments	2–7	2–9
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By Order of the Secretary of the Army:

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Distribution:

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☆U.S. GOVERNMENT PRINTING OFFICE: 1990 261-872/20303